THE EVALUATION OF YOGA INTERVENTIONS FOR INDIVIDUALS WITH LIMITED MOBILITY: PAIN, PSYCHOLOGICAL VARIABLES, AND MINDFULNESS

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Abstract

Objective: The aim of this dissertation was to evaluate specialized yoga interventions for populations with complex chronic health conditions involving chronic pain and limited mobility.

Method: Three research trials were conducted at two rehabilitation hospitals in Toronto. In Study 1, participants (N = 10) admitted to Bridgepoint Health were recruited to participate in an 8-week, Hatha yoga program. In Study 2, participants with spinal cord injury (SCI, N = 12) were recruited to participate in an 8-week, Hatha yoga program at the Lyndhurst Centre. In Study 3, participants with SCI (N = 23) were randomized to a 6-week, Iyengar yoga group (IY, n = 11) or to a wait-list control group (WLC, n = 12). Questionnaires on pain, psychological variables, and mindfulness, were collected at two or three points in time.

Results: In Study 1, repeated measures ANOVAs revealed a main effect of time for anxiety, self-compassion, and the magnification aspect of pain catastrophizing, such that anxiety and pain catastrophizing decreased and self-compassion increased from pre- to post-intervention. In Study 2, there were no significant changes in the quantitative measures but qualitative analysis of the semi-structured interviews revealed main themes regarding benefits along emotional, mental and physical domains. In Study 3, linear mixed effects growth models were conducted to evaluate main effects of group at T2, controlling for T1 scores. Depression scores were lower and self-compassion scores were higher at T2 in the IY group compared to the WLC group. The two groups were combined and analyzed across time by comparing pre- and post-intervention scores. Main effects of time were found for depression scores, self-compassion, mindfulness (total score and subscale scores for mindful observing and mindful non-reactivity), such that depressive symptoms decreased and self-compassion and the various facets of mindfulness increased from pre- to post-intervention.

Discussion: The results from these studies show that a yoga program reduces depressive symptoms and increases self-compassion for individuals with SCI, and may also decrease anxiety and pain catastrophizing, and increase mindfulness for populations experiencing pain and limited mobility.

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Chapter 1: Introduction

The purpose of the present dissertation was to develop, evaluate, and document specialized yoga programs for individuals with complex health conditions, chronic pain and/or limited mobility. This dissertation is organized into five chapters. In Chapter 1, I introduce and describe the various traditions and lineages of yoga with an emphasis on yoga philosophy. I explain how the concepts from ancient scriptures may be applicable to yoga programs for populations experiencing health impacts, and summarize the status of current yoga research on these topics. In this chapter, I also introduce the two populations studied in this dissertation; individuals with complex, chronic disease and disability (CCDD) and individuals with spinal cord injury (SCI). I review predominant health impacts and the relevant pain, psychological, and mindfulness-based constructs for each of these populations. In Chapter 2, I present a 'researcher perspective' and the qualitative data analysis methodology. In Chapters 3-5, I review the three research projects that comprise the empirical portion of this dissertation. Each of these chapters presents the objectives and hypotheses for each study, as well as a published manuscript. Chapter 3 and Chapter 5 also each contain a section on qualitative data methodology and results, which have not been published. Finally, I conclude with a general discussion in Chapter 6, where I first summarize the findings from each of the studies and review whether hypotheses were confirmed or disconfirmed. I then discuss the clinical and research implications of this dissertation, speak to the future directions of this area of research, and make concluding remarks.

Section 1: Introduction to Yoga

Definitions of yoga in classical scripture.

Yoga is an ancient mind-body practice that is embedded in Vedic traditions dating back to 3000 BC (Feuerstein, 2008) and which is being applied in developed countries as a broad remedy to attenuate health-related symptoms in clinical populations (Field, 2011; Wren, Wright, Carson, & Keefe, 2011) across institutional, community, commercial, and private settings. The word yoga comes from the Sanskrit term "yug" which has several interpretations; most commonly it is translated as a state of union or integration. This definition stems from some of the oldest scriptures of yoga, the Upaniṣads, and Vedānta, and it has connotations of mysticism and transcendent consciousness. In this context, yoga is considered a union of the individual self (jivātmā) with its essential nature or Universal Self (Paramātmā) (Feuerstein, 2008; Sovik & Bhavanani, 2016). However, this definition of yoga as union is also evident in other ancient texts, such as the Bhagavad Gītā, the Hatha Yoga Pradīpikā, and Charaka Samithā (text on āyurveda). In these texts, yoga is outlined as an integration of opposite forces to foster physical health, mental well-being, the development of the self, and mind-body unity (Muktibodhananda, 2005). For example, Hatha Yoga is comprised of the terms "ha", which refers to the sun (heating, activating, and energizing properties), and "tha," which refers to the moon (calming, cooling, and receptive properties), and the goal of this system to balance these polar qualities with consequent improved health.

When considered in the context of eastern philosophical systems such as Patañjali's Yoga Sūtras, yoga is traditionally understood as cultivating concentrative awareness and a unified experience of the self. This seminal scripture also defines yoga as a process of separation, which can be practically understood as a separation of the physical body from the deep abiding spirit within (Bechsgaard, 2013). Yoga as separation entails the cultivation of "witness consciousness"

which is the capacity to mindfully observe all facets of experience, and to differentiate between transient experiences of pain and suffering from the true self. By extension, the practice of yoga increases the capacity to dissolve the identification of the mind with inevitable experiences of pain and suffering (Bechsgaard, 2013). As a result, the student of yoga learns to experience difficult physical and mental/emotional states without being subsumed or overwhelmed by them. In addition, the student typically observes improved health through a separation process from afflictive cognitive, emotional, behavioural, and autonomic patterns and a shift towards adaptive coping skills and physiological reconditioning (Bechsgaard, 2013; Gard, Noggle, Park, Vago, & Wilson, 2014). As such, yoga is most recognized for its potential to create balance along mental, emotional, physical and spiritual dimensions. Other scriptures, such as the Bhagavad Gītā, define yoga as skill in action, equanimity of mind, or living with moderation and wisdom in activities (Kripananda, 1989). In this lineage, the student of yoga learns to cultivate a "yogic" attitude while completing tasks of daily living, to engage with ethical conduct, and to maintain steadiness and peace while facing obstacles. Although yoga was traditionally used for the transmutation of consciousness and development of the student towards ultimate spiritual liberation, it is more frequently used in North America for stress reduction, health symptom improvement, and for the development of strength and mobility.

Yoga in health care.

In modern health care, yoga is gaining recognition for improving health and well-being and has been evaluated for both acute and chronic conditions in able-bodied and clinical populations (McCall, Ward, Roberts, & Heneghan, 2013; Wren et al., 2011). Yoga is garnering attention for its notable ability to simultaneously address multiple body systems (e.g.,

circulatory, neuroendocrine, musculoskeletal, respiratory, viscerosomatic, immunological) through a dynamic and bidirectional process consisting of both top-down and bottom-up constituents, and to yield benefits in well-being and symptom reduction (Gard et al., 2014; Wren et al., 2011). Burgeoning interest in yoga as a therapeutic intervention for a variety of health conditions has resulted in an increase in research in the past decade, with the volume of publications increasing by three-fold and more than 300 randomized controlled studies up until 2013 (Cramer, Lauche, & Dobos, 2014; Jeter, Slutsky, Singh, & Khalsa, 2015). Across many of these studies, yoga is reported to have many benefits. Although the literature is plagued by poor methodological design, there is a call for increased quality in the caliber of research design (McCall et al., 2013).

A plethora of lineages and schools of yoga are evaluated in yoga research that include but are not limited to: aṣṭāṅga, iyengar, hatha, anusara, Bikram, viniyoga, Jivamukti, kuṇḍalinī, sivananda, vinyaya, Patañjali, and Kripalu. Despite the distinctions in philosophical basis, approach to the physical postures, and the emphasis on different components across these models, the lineage or school of yoga doesn't appear to impact the odds of producing positive outcomes being derived by individuals with different conditions (Cramer, Lauche, Langhorst, & Dobos, 2016). As the field of yoga research continues to expand, there is a need to thoughtfully design tailored yoga interventions with rationales for specific health populations, according to school (e.g., iyengar, hatha), emphasized or selected components (e.g., breathing exercises, concentration practice), classes of postures (e.g., back bends, twists), frequency (e.g., number of classes per week), and duration of practice (e.g., length of each class, total number of classes) (Sherman, 2012). It is imperative to properly document the specifics of the yoga interventions to assist with understanding mechanisms and with replicability.

Common components in yoga research interventions.

In particular, research trials employing integrated yoga interventions have used a comprehensive system that incorporate physical postures (*āsana*), breathing exercises (*prāṇāyāma*), inner awareness (*pratyāhāra*), concentration (*dhāraṇā*), and meditation (*dhyāna*). This comprehensive system is codified in Patañjali's Yoga Sūtras according to eight limbs that were originally intended to be followed in a systematic manner. Through the development of restraints and observances, the student of yoga learns to self-regulate, control negative tendencies, foster peace in relationships, and develop stability of character. The first limb (*yama)* of yoga outlines a set of ethical restraints for conduct with others: non-violence (*ahimsa*), truthfulness (*satya*), non-stealing (*asteya*), ethical use of energy (*brahmacharya*), and non-covetousness (*aparigraha*). The second limb (*niyama*) is comprised of principles and observances: cleanliness (*śauca*), contentment (*santoṣa*), burning discipline (*tapas*), self-reflection (*svadhyaya*), and surrender to a higher principle (*Īśvarapraṇidhāna*). Although these first two limbs are not readily synonymous with current mainstream views of yoga, they are considered the foundation for a yogic path, and provide the student with many attributes that will be needed for the practice of yoga. The third limb (*āsana*), delineates the practice of physical postures and is meant to be undertaken once a solid foundation in the first two limbs is established. This most popularized limb has elicited interest in yoga in developed countries for the many benefits that it bestows on those who regularly practice. Students of yoga then progress to the subsequent limbs, breathing practices (*prāṇāyāma*), sense withdrawal (*pratyāhāra*), concentration (*dhāraṇā*), meditation (*dhyāna),* and finally, meditative absorption (*samādhi*) (Bechsgaard, 2013). The purpose of this progression is to assist the student in first controlling cognitive-affective experience, developing a healthy body, and in cultivating harmonious

relationships, before moving onto transcendental states of consciousness. As such, the first three limbs are termed the 'outer' limbs (*bahirāṅga*) as they are concerned with observable actions. The latter limbs are termed 'inner' limbs (*antarāṅga*) as they comprise practices that are subtle in nature and intended to create well-being through the practice of reducing the fluctuations of the mind (*vṛttis,* sūtra 1.2) (Iyengar, 2010). The 'outer' limbs, with an emphasis on the use of the postures, are taught broadly to students with varying abilities and health concerns. The 'inner' limbs are typically taught by more experienced teachers, and are more often taught to advanced students or students who require an alternative practice in place of vigorous postures. The last limb is reserved for the most seasoned practitioner and very few obtain this more esoteric state. Through the practice of this eight-fold path of yoga, the student unveils the various layers of the self, while progressively moving towards the deepest seed (*bīja*) of consciousness. The consideration and application of these eight limbs is now well documented in yoga research trials, with specific focus on the third (*āsana*), fourth (*prāṇāyāma*) and sixths limbs (*dhāraṇā*) for clinical populations for mental and physical health diagnoses.

Emerging concepts in the field of yoga research.

Emerging in this field are less well known eastern philosophical conceptualizations of the human condition and health. European and North American psychological frameworks categorize human experience broadly into: cognition, personality, emotion, social relationships, development, biophysiology, behavior, and volition, amongst other constructs. Similarly, there are various yogic classification systems for cataloguing human experience (Sedlmeier & Srinivas, 2016). Many of these elaborate philosophical systems posit that cognitive-affective and physical experiences are interconnected, and that activity in the mind will be mirrored by a

similar type of activity in the body. Some of these primary systems include the Vedāntic theory of self as sheaths (*kośas*), the āyurvedic theory of constitution (*doṣas*), the theory of constitutional qualities (*guṇas*) and Patañjali's theory of afflictions (*kleśas*). As the field of yoga research evolves, these more esoteric conceptualizations of the personality or mind are becoming increasingly considered in the development of yoga programs, and are being contrasted with North American psychological frameworks (Khalsa, Telles, Cohen, & McCall, 2016b). It has been proposed that these systems have not been of greater focus in the modern application of ancient practices due to the inclusion of religious or moral doctrines that are incompatible with secular models of health care and language that is inaccessible or seemingly contrary to the biopsychosocial sciences (Sedlmeier & Srinivas, 2016). However, given the currently ineffective treatments for non-communicable diseases that involve pain and stress, health care systems have been turning to unorthodox modalities for adjuvant therapy options. Although this interest began with the popularized physical postures of yoga, it is shifting towards a holistic approach that includes a more comprehensive view of the historical foundations (Khalsa et al., 2016b).

Kośa theory: self as sheaths.

According to the Vedic conceptualization of the self, manifestation of matter (physical and psychological) are housed within five sheaths (*kośas)*, or layers, of the self. Unlike the biochemical reductionist understanding of human anatomy and processes, this framework considers the physical form to be just one of five components of the self. According to Indian philosophy, each of the five layers serves as a doorway inwards, and that each must be purified and strengthened in order to move towards a peaceful state of being. The outermost layer, *annamaya kośa*, which is literally translated as the "food body," refers to the physical body and its various structures (e.g., musculature, bones, organs) and processes (e.g., instinctive drives,

sex, sleep, physiology) (Feuerstein, 2008). This *kośa* is the focus of biomedical concerns regarding physical disease states. The second layer, *prāṇamaya kośa*, refers to the internal energy of the body (*prāṇa*) and is a force that animates the body and mind with vitality. The breath is typically used as a vehicle to modulate thought patterns and positively impact health (Iyengar, 2010). The third layer, *manomaya kośa*, represents the mental layer of existence, and is most coherent with psychological formulations of personality, emotion, cognition, and motivation (Feuerstein, 2008). However, the primary functioning of this layer is instinctual, automatic, habitual and unconscious, differentiating it from current personality constructs. The fourth layer, *vijñānamaya kośa,* represents the "wisdom mind," or a psychological orientation to important values, peace, and discernment. It is considered to predominate the conscious mind after ample engagement in meditative, relaxation, and concentration practices. The final layer, *ānandamaya kośa,* represents the most subtle layer of self and is an embodied state of rapture or "bliss" that emerges with continued practice (Feuerstein, 2008). Using the various inner limbs of yoga, the practitioner transforms these layers of self, moving towards the core (*ātman*) of health and serenity. There have been no research trials evaluating yoga interventions that employ this system as the primary focus, but it has been incorporated into one yoga intervention for individuals with complex multi-morbidities, which is one of the trials that comprise this dissertation (Curtis, Kuluski, Bechsgaard, Ridgway, & Katz, 2016). There has also been a theoretical proposal of the application of *kośa* theory as part of a yoga program for irritable bowel syndrome system (Kavuri, Raghuram, Malamud, & Selvan, 2015) and there has been a call for empirically sound, clinically meaningful, and culturally competent research on this topic for the maturing field of yoga research (Narayanan, 2007).

Āyurvedic concepts (dośas and guṇas) for yoga therapy.

Complementary to ancient texts on yoga philosophy, are texts of Āyurveda and Samkhya philosophy. Āyurveda is the traditional health system of India and is translated as the science of life and longevity (*āyu* is life, and *veda* is wisdom; therefore, wisdom of life), and is concerned with equilibrium and homeostatic functions in relation to health (Lad, 2012). It is being increasingly incorporated into personalized yoga therapy programs in health care systems to assist with promoting health and disease symptom attenuation (McCall, Satish, & Tiwari, 2016). Yoga therapy differs from general yoga classes in that it consists of individual consultations based on a health assessment by a yoga therapist. The assessment is similar to biomedical models in that there is a comprehensive review of physical and psychopathology but differs in the evaluation of aspects that are particular to yoga, such as the function of the breath and constitutional qualities (McCall, Satish, et al., 2016). Yoga therapy galvanizes the individual to engage with lifestyle changes and daily health practices (*chikitsā*) that are seasonally aligned, sustainable, and promote long-term health (Lad, 2012). It simplifies and modifies various yogic tools to optimize the impact of these practices and reduce the potential of harm for vulnerable individuals (McCall, Satish, et al., 2016). This is often done through the use of yoga props, such as blocks, straps, chairs, wraps, blankets, and bolsters, which assist in obtaining the effect of the posture in the presence of fatigue, weakness, or mobility limitations. Although yoga therapy is considered to be a distinct field from general yoga, the two consist along a spectrum and yoga therapy principles are often utilized in research-based yoga programs for health populations.

Ideologically, āyurveda considers the theories of *dośas* and *guṇas* in the assessment and prescription process. The *dośic* theory classifies individuals according to three phenotypic categories, *vāta*, *pitta*, or *kapha*, which each consists of constitutional qualities and characteristics present in both the body and the mind (Lad, 2012). An important facet of this

theory is the inextricability of the body and mind and the position that these qualities manifest in a similar manner across physical and cognitive-affective experience. Each classification has predominant qualities and imbalances in these properties are understood to result in health imbalances. *Vāta*'s primary qualities are dry, light, cool, irregular, and mobile, and it corresponds with health imbalances such as insomnia, pain, tremors, and anxiety. *Pitta*'s primary qualities are heat, oily, intense, and fluid, and it corresponds with health imbalances such as inflammation, nausea, and rashes, and anger. *Kapha*'s primary qualities are cool, heavy, dense, stable, and smooth, and it corresponds with health imbalances such as obesity, fatigue, and excess mucous (Lad, 2012). A basic example helps to illustrate this theory in practice: an imbalance in *kapha* may result in overweight, depressive symptoms, and edema, all of which are considered to be rectified by the practice of vigorous standing and back-bending postures.

A related āyurvedic theory of health and wellness is the *guṇa* theory, which posits that that there are three primary compositional properties of all matter: *tamas, rajas,* and *sattva*. The first of these is *tamas*, which represents a state of heaviness, lethargy, and stagnation; the second is *rajas*, which represents a state of activity, overexertion, agitation, and stimulation; and the third is *sattva*, which represent clarity, peace and balance. Imbalances in both *dośas* and *guṇas* are possible in the body or the mind and are considered to contribute to disease processes (McCall, Satish, et al., 2016). Although these hermetic concepts may seem unrelated to the physical postures that are commonly associated with yoga in developed nations, they are beginning to be incorporated into current yoga research trials for physical and mental health (Amaranath, Nagendra, & Deshpande, 2016; Braun et al., 2016; Khemka, Ramarao, & Hankey, 2011; Telles, Pathak, Kumar, Mishra, & Balkrishna, 2015a). For example, an excess of *tamas* would be mitigated with yoga postures that lift the chest (poses involving active arm work),

create circulatory movement (poses involving sequencing of jumping), and require mental focus (poses that involve balance). Additionally, these concepts are considered to be important and emerging constructs in the field of yoga research and may be applied in future research trials seeking to specialize yoga therapy for specific disease states (Khalsa, Telles, Cohen, & McCall, 2016a; McCall, Satish, et al., 2016).

Kleśa theory: afflictions of the mind.

Finally, Patañjali's theory of the *kleśas* outlines the primary psychological afflictions (sūtra 2.3); ignorance (*avidyā*), ego or "I-ness" (*asmitā*), desires (*rāga*), aversion (*dveśa*), and fear of death (*abhiniveṣa*). These afflictions are various mental proclivities towards erroneous knowledge, identification with superficial or conditioned states of consciousness, attachment to pleasurable experiences, a dislike of challenging experiences, and fear of the natural decline of the body over time (Iyengar, 2012). These states are considered mental imbalances that promote stress, suffering and disease risk factors (Khalsa et al., 2016b). Practically, this theory could be understood in the context of receiving a new medical diagnosis; if an individual responds with aversion (*dveśa*), they may be more vulnerable to stress-based reactions rather than adaptive coping. To date, no single research trial has evaluated *kleśa* theory didactics as part of a yoga intervention. However, it may be that these concepts will be relevant for individuals with intractable medical conditions in which pain, stress, and physical disabilities are predominant features. Severe and impairing illness can involve a loss of meaningful activities, relationships, and self-identity, and subsequently an impoverished sense of autonomy and agency (Ahlstrom, 2007). The mental practices of non-attachment to positive experiences, and acceptance of difficult experiences with pain, that are coherent with *kleśa* theory, may be useful for these populations in creating a reorientation to devastating loss through an integrated yoga program.

In summary, current yoga research trials have applied accessible and easily translatable yoga philosophy concepts, mostly stemming from the 8-limbs of yoga. These limbs chronicle instructions for moral and ethical observances, and provide a roadmap for progressing with various yoga practices, such as the postures, breath awareness training, and concentration building exercises. However, as the field expands and matures, there is growing interest in other traditional yogic techniques for improving health, especially for vulnerable populations. In order to meaningfully apply the therapeutic techniques, the associated foundational philosophical principles must be understood. The integration of philosophical concepts with physical practice may provide a platform for individuals with complex health concerns to engage with both mental and physical experiences in a safe, supportive and growth-promoting manner. Complementary frameworks for classifying human experience are provided by various ancient scriptures: self as sheaths (*kośas*); constitution (*doṣas*); compositional qualities (*guṇas*); and afflictions (*kleśas*). Each of these can inform the design of yoga research interventions through selection of postures (e.g., back-bending postures for uplifting *tamasic* qualities), breathing practices (e.g., slower practices for *vāta* constitution), or simply through didactics on adaptation, coping, and alternative orientations to stress, suffering, and pain (e.g., instructions on how to manage the natural inclination to avoid to suffering, *dveśa kleśa*). The application of these concepts in yoga research trials is at the stage of inception but are pertinent for this field that is simultaneously advocating for scientific validity and seeking to honour an ancient tradition.

The purpose of the present dissertation was to develop, evaluate, and document specialized yoga programs for individuals with complex health conditions, limited mobility, and/or chronic pain. These projects evaluated pain, psychological variables and mindfulness constructs for individuals with multi-morbidity or spinal cord injury. All of the research projects

utilized a comprehensive yoga program, including physical postures (*āsana*), breathing practices (*prāṇāyāma*), concentration (*dhāraṇā*), meditation (*dhyāna)*, and philosophical concepts, which is consistent with current yoga research literature. They were all informed by or included many of these anagogic frameworks (*kośa, dośa*, *guṇa, kleśa* theories) either implicitly in the design of the yoga programs or explicitly in the philosophical didactics. The yoga programs were relatively short in duration (6-8 weeks) and frequency (50-60 minute classes, 1-2 classes per week). The specific objectives and hypotheses of each project will be discussed in the chapters below.

Section 2: Yoga and Chronic Complex Disease and Disability

Chronic complex disease and disability.

Chronic complex disease and disability (CCDD) is a term that identifies individuals who have been diagnosed with multi-morbidities that affect psychological, social, physical, and vocational functioning and require health care resource utilization (Kuluski, Bensimon, et al., 2013; Schaink et al., 2012; Steele Gray et al., 2016). Individuals with complex health conditions have been identified as unique in terms of their specific health care needs and health-related experiences (Kuluski, Bensimon, et al., 2013). The diversity of disease combinations reported as multi-morbidities vary widely but the most common diseases that contribute to multimorbid conditions are diabetes, stroke, hypertension, and cancer, and consistent across studies of this population is the severity of the impact of having multiple conditions (Diederichs, Berger, & Bartels, 2011; Wallace et al., 2015). Some of these conditions have been reported to be of the highest prevalence in an Ontario sample with multi-morbidity, which included arthritis, hypertension, asthma, diabetes, and cancer (Pefoyo et al., 2015).

Multi-morbidity has been associated with low socio-economic status, female gender, and older age in both longitudinal and cross-sectional studies, with prevalence and incidence rates in older age reported at 55% and 12-33%, respectively, and prevalence rates in young-middle age at 11.3-15.4% (Marengoni et al., 2011; Marengoni, Winblad, Karp, & Fratiglioni, 2008; Melis, Marengoni, Angleman, & Fratiglioni, 2014; Violan et al., 2014). Older age predicts multi-morbidity in those with one chronic condition and the presence of mental health conditions predict multi-morbidity for those with no chronic disorders and increases with the number of physical ailments (Barnett et al., 2012; Marengoni et al., 2011; Marengoni et al., 2008). Patterns of multi-morbidity have been reported to differ across age, gender, and socioeconomic class in the Catalonian population, but circulatory-endocrine-metabolic conditions are reported to be constant across gender after the age of 45 years (Violan et al., 2014). Patterns of lipid disorder and uncomplicated hypertension were the top two most frequent conditions that accompany other chronic conditions for both genders, and other conditions that were in the top ten most frequent conditions for this population included anxiety and depressive disorder, obesity, diabetes mellitus (type 2), and back pain, osteoarthritis, osteoporosis, varicose veins, benign prostate hypertrophy, endocrine/metabolic/nutrient disease or chronic alcohol abuse (Violan et al., 2014). It's clear that multi-morbidity is a complex and heterogeneous disease state, with many of the most prevalent conditions being of global concern, and is increasingly becoming the norm rather than the exception, resulting in high health care resource use.

Chronic diseases account for 59% of annual deaths and 46% of the global burden of disease (Mathers & Loncar, 2006). In Canada, 42% of total direct medical care expenses are allotted to the treatment of chronic diseases (Mirolla, 2004), with up to $52,661 spent on average for the last year of life, in part due to in-patient and long term care costs (Tanuseputro et al.,

2015). Despite the clear priority of the medical community to address the needs of individuals with chronic disease, the orientation of the health care system as an acute-care focused model means that care for individuals with chronic disease is often ineffective, leaving those with many chronic conditions underserviced (Fortin et al., 2013). A complexity framework has been proposed to guide research and approach to patient complexity, which incorporates five health dimensions: medical/physical health, health and social experiences, demographics, mental health, and social capital (Schaink et al., 2012). Understanding the relationships between physical, psychological, and social factors of health and in multi-morbidity has been identified as necessary for effective treatment for individuals who are impacted by intersectionality (Fortin, Hudon, Bayliss, Soubhi, & Lapointe, 2007).

A structural shift towards care that is not disease/injury focused but emphasizes addressing many needs at once has been recommended and considered for Canada (Andrew & Rockwood, 2014) and several provinces in Canada have focused on improving policy cohesion regarding intervention outputs for chronic disease prevention, including healthy behaviours and increased public awareness (Kothari et al., 2013). A remodeling of chronic disease services has been implemented in Quebec to improve patient self-efficacy, functional health status, health-related behaviours and psychological well-being through an intervention purposed to harmoniously integrate patient-centred care, motivational interviewing, self-management support, and coordination of services between the primary health team and auxiliary supports (Fortin et al., 2013). This two-pronged approach (systemic and patient-centred) to interventions has also been reported in a meta-analysis which recommends the development and evaluation of interventions that target risk factors, such as depression or functional ability, may be particularly useful for this population (Smith, Wallace, O'Dowd, & Fortin, 2016). Perceived risk factors have

been identified by hospital patients with complex multiple health diagnoses as partly attributable to shortcomings of health care providers and uncoordinated services within the health system at large (Kuluski, Tracy, & Upshur, 2015). Despite an increase in research over the past two decades on multi-morbidity, there is still limited research on effective interventions to adequately service this population (Onder et al., 2015; Smith et al., 2016), which highlights a need for the development and evaluation of programs that are designed to address the needs of individuals who are managing multiple intersecting health impacts of a chronic nature.

Sinai Health System, Bridgepoint Health (BH).

BH (Toronto, Canada) is a health care delivery system that focuses on individuals with complex health conditions and values patient-centred care. Patients at BH are designated to one of two streams: 1) complex chronic conditions (CCC) or 2) medical rehabilitation (MR), though it is possible for patients to be designated as both having CCC and in need of MR. CCC is comparable term to CCDD as it identifies individuals who have been diagnosed with multiple health impacts that impair functioning and require ongoing health care (Kuluski, Hoang, et al., 2013). Although there are two distinct streams at BH, it is possible for patients to transition seamlessly across the two streams and access similar services from either stream.

BH patients have been reported to have an average of five health conditions (co-morbidities) with stroke and hypertension being the most common primary and secondary diagnosis, respectively. Other primary diagnoses include a fracture of the neck or the femur, the presence of an artificial knee, fatigue or malaise, multiple sclerosis and other demyelinating diseases of the CNS, and the presence of an artificial hip. Secondary diagnoses include benign hypertension, gonarthrosis unspecified, ataxia unspecified, multiple sclerosis, diabetes mellitus

(type two or unspecified), COPD unspecified, dependence on renal dialysis, malignant neoplasm of breast, malignant neoplasm of prostate, depressive episodes, and pure hypercholesterolemia (Lyons et al., 2012). The most frequently reported symptoms are pain (78%), weakness (71%), emotional upset/distress (70%), and illness related symptoms (nausea, vomiting, chest pain, difficulty breathing) (46%). Functional challenges include mobility (83%), activities of daily living (60%), equipment devices (43%), paying attention (48%), sensory challenges, and carrying a conversation (27%) (Lyons et al., 2012). In addition, 44% of patients typically display depressive symptomology (depression, anxiety and stress) and 61-62% of patients report being lonely and isolated. Disruptions in independence, recreational activities, occupational and social roles, as well as sense of self and identity are also reported (Lyons et al., 2012).

The impact of health conditions on individuals with chronic complex diseases involves the loss of: 1) autonomy (impact of physical limitations on life); 2) meaningful activities (recreation, work, daily living); 3) structures of meaning (home, pets and care); 4) social fabric (disruptions to social roles and relationships and isolation); 5) mental health (depression, anxiety, stress, threats to integrity of well-being); and 6) finances (decrease of financial security) (Kuluski, Bensimon, et al., 2013). It is clear that there is a need for interventions that focus on improving multiple dimensions of health and well-being, with the primary purpose of symptom reduction, improved vitality and increased quality of life and activities of daily living.

Yoga and CCDD.

There is evidence from randomized controlled trials that yoga is effective in the treatment of a variety of chronic conditions either as a stand-alone treatment or as an adjuvant therapy. Yoga has been shown to be effective in reducing pain and disability for individuals with low

back pain (Holtzman & Beggs, 2013), neck pain (Cramer, Lauche, Hohmann, et al., 2013; Michalsen et al., 2012), knee and hand osteoarthritis (Ebnezar, Nagarathna, Yogitha, & Nagendra, 2012; Garfinkel, Schumacher, Husain, Levy, & Reshetar, 1994), and rheumatic disease and fibromyalgia (Cramer, Lauche, Langhorst, & Dobos, 2013; Ward, Stebbings, Cherkin, & Baxter, 2013). Randomized controlled trials have also demonstrated that a yoga practice results in improvements in biological indices important in the management of diabetes (Innes & Selfe, 2016), oxidative factors for end stage renal disease (Gordon, McGrowder, Pena, Cabrera, & Lawrence-Wright, 2013; Yurtkuran, Alp, & Dilek, 2007), diastolic and systolic blood pressure (Hagins, States, Selfe, & Innes, 2013), fatigue and psychosocial outcomes for cancer (Buffart et al., 2012; Harder, Parlour, & Jenkins, 2012; Sadja & Mills, 2013), psychological factors post-stroke (Thayabaranathan et al., 2017), distress and functional performance in chronic respiratory disease (Donesky-Cuenco, Nguyen, Paul, & Carrieri-Kohlman, 2009), psychiatric conditions (depression and sleep disorder) (Balasubramaniam, Telles, & Doraiswamy, 2013), and fatigue and mood related impacts for multiple sclerosis (Cramer, Lauche, Azizi, Dobos, & Langhorst, 2014) (Braun, Park, & Conboy, 2012; Salgado et al., 2013). There is also preliminary evidence from a RCT for within group improvements for stroke-related disability (e.g., balance) (Schmid et al., 2012). Despite this promising evidence, the methodological shortcomings (e.g., small sample sizes, use of non-active control group) or/and low effect sizes make it difficult to draw firm conclusions regarding efficacy of yoga for symptom attenuation. There is a consensus in the field of yoga research that the quality of research evaluating yoga for both acute and chronic conditions is generally poor (e.g., lack of control groups, lack of randomization of control groups, small sample sizes, lack of reporting on interventions) and there is considerable variability in populations studied, style of yoga, study design and type of site (e.g., hospital,

clinic, community setting, etc.) (McCall et al., 2013). Although there is an abundance of research evaluating the impact of yoga on chronic conditions, this dissertation presents the first research trial evaluating the effects of a yoga intervention on individuals with complex chronic disease or who were undergoing medical rehabilitation for complex multi-morbidities.

Although yoga research studies have not been conducted in this clinical population, there is evidence in the field of yoga research that supports the use of yoga for many of the common primary and secondary diagnoses that are reported by BH patients (e.g., stroke, hypertension, musculoskeletal conditions, multiple sclerosis, hypertension, arthritis, renal disease, depression, diabetes, COPD, cholesterol levels, breast and prostate cancer). Although there is evidence from RCTs supporting the use of yoga for some of these conditions (e.g., musculoskeletal conditions, hypertension, renal disease), there is preliminary evidence from pilot trials or within group improvements for other impacts, such as post-stroke balance. It is possible that yoga may help to improve many of the multiple health needs these individuals report as being important. Pain, fatigue, emotional upset, nausea, difficulty breathing and facets of living that are disrupted (e.g., mobility, balance, social well-being) have also been shown by RCTS to improve with yoga practice (Buffart et al., 2012; Harder et al., 2012; Papp, Lindfors, Wandell, & Nygren-Bonnier, 2016; Raghavendra et al., 2007; Wren et al., 2011; Youkhana, Dean, Wolff, Sherrington, & Tiedemann, 2016). There is qualitative evidence for the positive impact of yoga on intra- and inter-personal factors, such as sense of connectedness, belongingness, self-transformation, sense of purpose, and acceptance of a different body (Garrett, Immink, & Hillier, 2011), which may be applicable to the disruptions in meaning, identity, and purpose reported by BH patients. Moreover, yoga provides a lasting behavioural skillset that increases confidence and self-efficacy, can be used in the treatment of chronic conditions for both low and high-income

populations, is associated with treatment adherence in sedentary adults, and holds promise as a cost-effective treatment for chronic conditions (Bryan, Pinto Zipp, & Parasher, 2012; Bussing, Michalsen, Khalsa, Telles, & Sherman, 2012; Chuang et al., 2012; Saper et al., 2013). In addition, the role of stress in the development, maintenance and exacerbation of chronic and non-communicable diseases is now widely accepted and therefore, lifestyle factors that remediate stress, such as yoga, are of increasing value (Khalsa et al., 2016b). Complementary and alternative therapies such as yoga have been recommended for integration into clinical health psychology settings in order to more broadly address well-being, spirituality, multiple health problems, dissatisfaction with the effectiveness of orthodox medicine and disease prevention (Park, 2013). Therefore, research evaluating the impact of yoga on psychological, physical, functional and social factors in individuals with complex chronic health conditions is warranted.

Section 3: Yoga and Spinal Cord Injury

Sustaining a spinal cord injury (SCI) is a life changing experience, which can result in motor, sensory, and autonomic impairments, psychological disorders, and chronic pain (Hassanijirdehi et al., 2015; Kirshblum, 2005). Rehabilitation in the post-SCI period is often focused on physical therapies and providing psychological interventions to support the recovery process, which may include access to resources or services to foster physical activity engagement. The post-SCI period requires a reorientation to meaningful life activities and flexibility engaging with new challenges in the context of abrupt physical and emotional changes (Littooij et al., 2015).

Psychological Distress after SCI.

With respect to mood and psychological well-being, persons with SCI have lower positive affect and greater levels of depression when compared to age-matched controls (Salter, Smith, & Ethans, 2013). A recent meta-analysis evaluating diagnosis of depression after SCI found that the mean prevalence was 22.2%, which is considerably higher than the general population (Williams & Murray, 2015) and a cross-sectional survey in a community setting of individuals with SCI found that 29% of individuals were receiving anti-depressant medication (Fann et al., 2011). In a representative, community cross-sectional self-report survey, 37% of individuals reported experiencing depression and 30% reported experiencing anxiety (Migliorini, Tonge, & Taleporos, 2008). Females who have sustained traumatic SCI have higher levels of depression and anxiety than males, and individuals with higher pain also report higher levels of anxiety and depression (Al-Owesie, Moussa, & Robert, 2012). Physical and mental health experiences intersect in individuals with SCI; those who report higher levels of fatigue also report higher levels of depression, anxiety and lower levels of self-efficacy and quality of life (Craig, Tran, Wijesuriya, & Middleton, 2012; Wijesuriya, Tran, Middleton, & Craig, 2012).

Pain and related experience after SCI.

Individuals with SCI report higher levels of pain than normative samples, with a prevalence of 81%, and which can impact physical, social and psychological functioning, as well as activities of daily living (Jensen, Hoffman, & Cardenas, 2005; Siddall, McClelland, Rutkowski, & Cousins, 2003). Pain in individuals who have sustained SCI is classified by the International SCI Pain Classification system according to three tiers (Mehta et al., 2016). The first tier classifies the type of pain (e.g., nociceptive, neuropathic, or “other”) and the second tier classifies the subtype of pain. Subtypes of nociceptive pain are classified as musculoskeletal,

visceral, or "other," and subtypes of neuropathic pain are classified as "at level SCI," "below level SCI" and "other." The third tier includes the primary pain source and pathology, and it is recommended to also consider pain intensity. This system parallels earlier systems that classify pain according to etiology, pathology, location, severity and quality, and according to four dimensions; musculoskeletal, visceral, neuropathic, or "other" types, all of which significantly impact QoL (Hassanijirdehi et al., 2015).

Pain is also classified relative to the level of the spinal injury: pain below the level of the injury tends to be neuropathic in nature and depending on the completeness of the lesion may be akin to phantom pain. This pain is often referred to the lower limbs via the convergence and summation of inputs (somatic and visceral) in higher CNS structures. Pain above the level of the injury tends to be musculoskeletal in nature and may arise from overuse. Musculoskeletal pain in individuals with traumatic SCI has been reported to be the most frequently reported type of pain (Siddall et al., 2003). A cross-sectional research study evaluating a chronic pain model in SCI revealed that chronic pain contributes to depressed mood and that pain and depression each predict chronic fatigue. This same study also found that self-efficacy mediated the impact of chronic pain on depression, such that self-efficacy diminished the negative impact of pain on mood (Craig et al., 2013). Pain is a predominant symptom in individuals who have sustained SCI, is closely related to psychological well-being, and should be a major focus in rehabilitation strategies.

Pain treatments for individuals with SCI are traditionally pharmacological in nature. The most frequently studied and prescribed are tricyclic anti-depressants and anti-epileptics, and there are conflicting results from randomized controlled trials regarding the efficacy of both classes of medication for the treatment of neuropathic pain (Hagen & Rekand, 2015). However,

the efficacy of pharmacological treatment is limited and these medications are often accompanied by side effects, so non-pharmacological interventions are recommended as adjuncts (Boldt et al., 2014). Although a recent review reported that many alternative, non-pharmacological interventions (repetitive transcranial magnetic stimulation, transcutaneous electrical nerve stimulation, cranial electrotherapy stimulation, acupuncture, self-hypnosis, or cognitive behavioural therapy) have shown no benefit in reducing chronic pain in individuals with SCI, these authors also concluded that exercise programs have demonstrated reductions in chronic shoulder pain in individuals with SCI using standardized measures (Boldt et al., 2014). By contrast, within group improvements were found in a pilot study evaluating massage therapy and acupuncture for individuals with SCI; individuals receiving acupuncture reported improvements in present pain, general pain, pain unpleasantness and coping, while individuals receiving massage therapy reported improvements in pain interference, from baseline to post-intervention, using intent-to-treat analysis (Norrbrink & Lundeberg, 2011). Similarly, a research trial using a collapsed randomized controlled design (wait-list control merged with the intervention group) to evaluate a multidisciplinary cognitive behavioural therapy intervention for coping with neuropathic pain post-SCI found improvements in pain coping (active subscale total score, pain transformation, and pain worrying) and in pain cognition scales (catastrophizing, optimism, and reliance on health care) (Heutink et al., 2013). Other types of psychology interventions that address pain have also been evaluated in this population. For instance, computer-based positive psychology intervention resulted in pre- to post-intervention improvements in pain intensity, pain control, pain interference, pain catastrophizing, life satisfaction, depression, and positive affect in individuals with chronic pain (SCI, multiple sclerosis, post-polio disease or neuromuscular disease). This RCT also found pre- to post-

intervention improvements in the treatment group when compared to controls in pain intensity and pain control (Peter et al., 2015).

According to the fear-avoidance model of chronic pain, pain catastrophizing, pain-related fears and pain-related anxiety all contribute to the development and maintenance of chronic pain (Vlaeyen & Linton, 2000). This model posits that negative appraisals of internal and external stimuli result in escape and avoidance behaviours, which lead to behavioural inactivity, the deconditioning syndrome, and disability (Vlaeyen & Linton, 2000). Pain-related cognitions, such as pain catastrophizing, are recognized as negatively impacting pain related-experiences and functional ability in individuals with SCI and other disability populations (Jensen, Moore, Bockow, Ehde, & Engel, 2011). Both active and passive pain-related coping statements (e.g., distancing from pain, coping self-statements, and praying) have been correlated with pain intensity and unpleasantness in individuals with SCI in a pilot, longitudinal study and it is recommended that pain coping styles be addressed in the rehabilitation process to best tailor treatments to different response types (Taylor et al., 2012). Pain catastrophizing and lower levels of self-efficacy are associated with risk of psychological disorders in individuals with SCI, which points to the importance of implementing skill-based strategies for working with pain-related cognitions to help bolster inner resources and protect individuals from developing psychological disorders (Craig et al., 2015).

Increasing inner resources after SCI.

Current rehabilitation models typically focus on symptom reduction or health vulnerabilities, but there is increasing recognition that augmenting inner resources (e.g., self-efficacy, resilience, self-compassion, psychological flexibility, post-traumatic growth) may serve

as a buffer from challenging experiences and/or create positive psychological change after SCI (Hayter & Dorstyn, 2014; Kilic, Dorstyn, & Guiver, 2013; Min et al., 2014). General self-efficacy has been identified as a potentially useful target to increase participation in activities after SCI. A cross-sectional study employing a convenience population found that self-efficacy was positively correlated with resilience while in hospital and at three months post-SCI, and that levels of self-efficacy predicts levels of resilience while in hospital (Driver et al., 2016). Similarly, self-efficacy, as well as low levels of depressed mood, predict resilience in individuals with SCI at discharge and six months post-discharge from an inpatient rehabilitation setting into the community (Guest, Craig, Tran, & Middleton, 2015). It has been recommended that rehabilitation strategies enhance self-efficacy by strengthening the relationship between behaviours and perceived goals through increased self-monitoring and self-awareness (Craig et al., 2015).

Positive outcomes that may occur as a result of adverse or traumatic events may present in a variety of facets of experience (e.g., relationships, life priorities, self-efficacy, self-esteem) and have been termed adversarial growth, posttraumatic growth, benefit finding, or positive by-products (McMillan & Cook, 2003). Posttraumatic growth refers to the profound self-transformation that can emerge from suffering, pain, and trauma, and posits that growth and adaptability can be natural consequences of traumatic experiences (Kalpakjian et al., 2014). A model examining posttraumatic growth, depression, demographics, and injury characteristics in a community based, cross-sectional study found that most individuals with SCI do experience some experiential growth post-injury and these authors recommended further development of conceptual models of this construct in the context of SCI (Kalpakjian et al., 2014). In addition, positive by-products have been observed in some individuals with traumatic SCI (motor vehicle

accident, falls, gunshots wounds) in the domains of family closeness and compassion (McMillan & Cook, 2003).

A related construct to posttraumatic growth is that of resilience, which refers to adaptive coping and the ability to respond flexibly to adverse life events in a positive and growth promoting way (Monden et al., 2014). This construct is particularly important in health conditions that can render an individual helpless or vulnerable to developing secondary psychological conditions. Resilience has been found to mediate the impact of pain on depression, such that resilience reduced the effect of pain severity on depression and was also found to independently predict both depression (negatively) and posttraumatic growth (positively) (Min et al., 2014). Results from a qualitative research trial conducting focus groups with a convenience sample indicate that individuals who sustained SCI describe resilience as consisting of psychological strength, social support, coping, perspective taking, coping, and spirituality, all of which impact ability to adapt in the context of traumatic experiences (Monden et al., 2014). Latent growth mixture modeling analysis of a longitudinal study evaluating individuals with SCI at six weeks, three months, one year, and two years found that resilient individuals have fewer SCI-related quality of life problems, evaluate stressors as challenges rather than threats, have greater acceptance and don't cope by using behavioural avoidance (Bonanno, Kennedy, Galatzer-Levy, Lude, & Elfstrom, 2012). Higher levels of resilience have also been associated with higher levels of self-efficacy, internal locus of control, and lower levels of psychological distress in community dwelling adults with SCI in a cross-sectional postal survey (Kilic et al., 2013). Specific models of resilience have accounted for 77% of variance of depression symptoms and it has been suggested that resilience may buffer the impact of SCI-related stressors on depression in a structural equation model project evaluating experiences of

Canadians with paraplegia (Catalano, Chan, Wilson, Chiu, & Muller, 2011). Other studies using structural equation modeling have demonstrated that higher levels of resilience are associated with higher levels of pain acceptance and that higher levels of pain acceptance are associated with lower levels of trauma-related symptoms. The authors present resilience as a protective factor and experiential avoidance as a vulnerability factor in pain adjustment after a traumatic event in a limited mobility population (back pain) (Ruiz-Parraga & Lopez-Martinez, 2015). Increasing resilience may be a useful target for rehabilitation and have secondary gains in terms of fostering positive growth post-SCI (Min et al., 2014).

Another construct that measures adaptive coping and positive growth is psychological flexibility. Psychological flexibility has been defined as the ability to recognize and adapt to situational demands, to shift out of unhelpful cognitive or behavioural patterns, to cultivate a sense of balance in important life areas in the context of stress, and to be aware of and committed to behaviours consistent with one's values (Kashdan & Rottenberg, 2010). Psychological inflexibility, it's sister term, is conceptualized in Acceptance and Commitment Therapy (ACT) as the intersection of 6 processes: experiential avoidance, cognitive fusion, attachment to self-concept, lack of contact with the present moment, unclear values, and the inability to behave in accordance with one's values (Hayes, Follette, & Linehan, 2004; Hayes, Strosahl, & Wilson, 2012). This paradigm proposes that human suffering stems from the interaction of language, cognition, and direct experience, and by rigidly adhering to concepts of self or narratives about the world. Suffering may be alleviated by contacting the present moment and flexibly allowing new experiences to inform one's understanding of the self and the self in-context (Hayes et al., 2012). Therefore, psychological flexibility is defined as contacting the present moment, inclusive of all cognitions, emotions, and direct experiences, without rigidly adhering to a personal

narrative, and depending on what the situation affords, using chosen behaviours to move towards long term values; while inflexibility is the negation of these abilities (Hayes, Luoma, Bond, Masuda, & Lillis, 2006).

Psychological flexibility has been found to mediate changes in a variety of psychological experiences, including self-compassion, psychological distress, anxiety, depression, and stress in a randomized controlled trial evaluating ACT versus a waitlist control (Yadavaia, Hayes, & Vilardaga, 2014). This construct has also been linked to positive functional outcomes, which are especially important in chronic pain and limited mobility populations where disability and disuse are present. In individuals undergoing interdisciplinary treatment for chronic pain, psychological flexibility (termed "general acceptance" by the authors) was found to be significantly and negatively associated with depression, (r = -.69), pain-related anxiety (r = -.59), physical disability (r = -.42), and psychosocial disability (r = -.65) (McCracken & Zhao-O'Brien, 2010). In this same population, it was also found to add a significant increment of explained variance of patient functioning, over and above the variance explained by pain, pain acceptance, and mindfulness (McCracken & Zhao-O'Brien, 2010). Similarly, when compared to pain intensity, psychological flexibility accounted for over two times as much of the variance (pain intensity: 9.2%, psychological flexibility: 24.1%) in a regression analysis involving predictors of health and physician visits, in a survey of community dwelling adults with chronic pain (McCracken & Velleman, 2010).

Psychological flexibility may play a role in the efficacy of psychological interventions that focus on pain, such that lower levels of flexibility may impede positive growth and prevent reductions in distress. High levels of both depression and catastrophizing have been correlated with lower levels of psychological flexibility in individuals with non-specific spinal pain and

psychological flexibility has been demonstrated to be a unique predictor of individuals remaining in a "poor pathway" of a CBT treatment trajectory (individuals with scores that did not improve over the course of treatment) (Flink, Boersma, & Linton, 2014). Elements from the psychological flexibility model, including psychological flexibility itself and pain acceptance, have been found to mediate therapeutic changes in CBT and ACT interventions on measures of life satisfaction, depression, pain, and pain related disability in chronic pain populations (Akerblom, Perrin, Rivano Fischer, & McCracken, 2015; Wicksell, Olsson, & Hayes, 2010). It has been suggested that psychological flexibility involves a willingness to experience distressing emotions or experiences rather than pushing up against them, which can create a platform for healing through which suffering can be reduced and daily functioning can be improved (McCracken & Zhao-O'Brien, 2010). To date, no research studies have evaluated psychological flexibility/inflexibility in a SCI population.

Mindfulness, self-compassion, and SCI.

Mindfulness is a paradigm that uses a variety of formal and informal meditation practices and has been recognized for gains in a variety of physical and mental health conditions. Mindfulness is rooted in Buddhist and contemplative philosophies and is characterized by paying attention in the present moment with a non-judgmental awareness of, and openness to, inner and outer experiences (Kabat-Zinn, 1994). Mindfulness has been found to negatively predict pain intensity, pain catastrophizing, pain-related fear, pain hypervigilance, negative affect and functional disability in chronic pain patients (Schutze, Rees, Preece, & Schutze, 2010). Acceptance cognitions, as well as self-efficacy, purpose in life and mastery, were found to be associated with better mental health, in a prospective study evaluating community dwelling

individuals with SCI (van Leeuwen, Edelaar-Peeters, Peter, Stiggelbout, & Post, 2015). The role of acceptance, positive body image, social support and resilience have all been discussed as important factors in healthy psychological adaptation to SCI (Bailey, Gammage, van Ingen, & Ditor, 2015). Furthermore, meditation is considered almost as effective as tricyclic antidepressants and anticonvulsant agents in the treatment of pain post-SCI (Cardenas & Felix, 2009).

In other disability populations, such as mild traumatic brain injury, a standardized but uncontrolled mindfulness-based stress reduction (MBSR) intervention resulted in clinically significant improvements in self-efficacy and quality of life from pre- to post-intervention (Azulay, Smart, Mott, & Cicerone, 2013). A randomized controlled trial evaluating cancer-related fatigue found that individuals randomized to an MBSR program reported significantly lower fatigue and depression from pre- to post-intervention than wait-list controls (Johns et al., 2014). Mindfulness is purported to be useful in a wide range of chronic conditions and a meta-analysis reported that MBSR programs consistently result in improvements in quality of life, psychological factors (depression, anxiety, coping style), affective elements of disability, and physical health (Grossman, Niemann, Schmidt, & Walach, 2004). It has been proposed that mindfulness may provide therapeutic gains by increasing compassion and psychological flexibility and by decreasing rumination tendencies (Chiesa, Anselmi, & Serretti, 2014). Mindfulness is a therapeutic platform that may provide individuals with SCI with a new tool to de-identify with experiences with pain, distress, and loss during the post-injury adaptation process.

Self-compassion, another Buddhist construct being used in contemporary psychological literature, is defined according to three components; mindfulness, self-kindness and shared

humanity (Neff, 2003). These processes work in concert to enable an individual to open to and contact their own suffering and pain without judgmental or comparative thought patterns, rather than to avoid it or disconnect from it and from which, a desire to alleviate suffering is born (Neff, 2003). Through situating oneself in the context of a shared humanity in which inadequacies, failings, suffering, and short-comings are considered part of the human condition, and an understanding that all humans are equally deserving of compassion, individuals are then able to extend forgiveness towards their own short-comings and pain and move towards caring responses (Neff, 2003). Self-compassion and mindfulness are similar in that self-compassion includes mindful awareness of distressing experiences but are distinct in that self-compassion extends to acts of kindness and support towards the self. Self-compassion has been associated with self-efficacy and resilience in individuals with spina bifida (Hayter & Dorstyn, 2014) and is a significant predictor of positive and negative affect, pain catastrophizing and pain disability in individuals with chronic pain and obesity (Wren et al., 2012). To date, there are no studies that have evaluated self-compassion in the context of a rehabilitation intervention or as theoretically relevant for a SCI population.

In summary, depression, anxiety, pain, and pain-related cognitions are features of the constellation of symptoms in the post-SCI period; self-efficacy, resilience, post-traumatic growth, psychological flexibility, mindfulness, and self-compassion may serve to attenuate some of the physical and emotional distress associated with SCI and create a context for meaning making in this period. There is a need for therapeutic interventions that are easily adaptable for persons with SCI and can be introduced post-injury in order to help maximize physical and mental health. Focus groups consisting of individuals with SCI and physicians indicate that there

is a need for highly individualized treatment approaches and a desire for complementary health therapies for SCI-related pain (Norrbrink & Lofgren, 2015).

Yoga for individuals with SCI.

Given its emphasis on mindfulness concepts, such as present-mindedness and acceptance, yoga may be a well-suited mind-body intervention for individuals with SCI. Prior to embarking on this dissertation, there were no research trials evaluating yoga for persons with SCI although it had been suggested that Iyengar yoga be integrated into SCI rehabilitation therapies to increase physical functioning and to cultivate a positive mind-body experience (Zwick, 2006). After the pilot study (see Chapter 4) had been completed in 2012, but before it had been published in 2015, a case report evaluating a twice weekly, twelve-week yoga intervention for an individual with SCI was published. The results of this case report suggested that yoga may improve balance, strength, endurance, flexibility, posture and functional outcomes (Moriello, Proper, Fink, & Mayack, 2014). Yoga has also yielded benefits in individuals with scoliosis with respect to the degree of curvature of the spine in a non-randomized trial, and there are now well documented benefits for yoga reducing functional disability for chronic back pain (Fishman, Groessl, & Sherman, 2014; Holtzman & Beggs, 2013). These preliminary results suggest that yoga may provide therapeutic utility for individuals with SCI.

As discussed in the previous section, randomized controlled trials evaluating yoga interventions have been shown to reduce pain, disability, and fatigue, and improve mood, and psychosocial outcomes for various disability groups or compromised populations with mobility impairments and/or chronic pain (e.g., osteoarthritis, rheumatoid arthritis, stroke, multiple sclerosis, fibromyalgia, chronic low back pain). Randomized controlled trials have also shown

that yoga positively impacts psychological experiences, such as psychological flexibility in relation to post-traumatic stress disorder symptoms, mood, anxiety, self-efficacy, sleep disorders, positive and negative affect in clinical and non-clinical populations (Balasubramaniam et al., 2013; Bonura & Tenenbaum, 2014; Dick, Niles, Street, DiMartino, & Mitchell, 2014; Vadiraja et al., 2009). There is qualitative evidence for the positive impact of yoga on belongingness, sense of connectedness, self-transformation, sense of purpose, and acceptance of changes to one's body in individuals who have sustained a stroke (Garrett et al., 2011), which may be relevant to individuals with SCI who must face new limits in the context of their injury. It has been proposed that yoga may serve to broaden an individual's repertoire of available resources in terms of open mindedness, creativity, curiosity, and acceptance of one's body, and therefore reduce constraints to physical activity engagement (Van Puymbroeck, Schmid, Shinew, & Hsieh, 2011; Van Puymbroeck, Smith, & Schmid, 2011). It is possible that yoga may also provide individuals with the opportunity to experiment with less rigid ways of thinking and increase the capacity to contact the present moment with a fresh perspective, which may be applied broadly to psychological patterns or experiences with pain or physical distress. Yoga programs may be easily modified for varying degrees of impairment and mobility, making it a highly accessible intervention for this community.

In summary, there is evidence from RCTs documenting the benefits of yoga for individuals experiencing pain, limited musculoskeletal movement, serious health events, or psychological disorders (e.g., arthritis, low back pain, stroke, depressive symptoms). This dissertation presents the first research trials evaluating the benefits of yoga for individuals with CCDD or SCI, for whom physical and psychological conditions are often co-morbid. This dissertation evaluated specialized yoga interventions that were designed in accordance with

current yoga research literature and with principles from the ancient tradition. The first research study in this dissertation (Chapter 3) used a pilot cohort study design to evaluate the impact of a specialized yoga program on pain (intensity, interference, catastrophizing), psychological factors (anxiety, depressive symptoms, experiences with injustice, stress, self-compassion, spiritual well-being), and mindfulness, in individuals receiving complex care or medical rehabilitation. The second research trial in this dissertation (Chapter 4) used a pilot cohort to evaluate the impact of a specialized yoga program on pain and related variables (intensity, interference, catastrophizing), psychological factors (positive and negative affect, self-efficacy), fatigue, and mindfulness in individuals with SCI who were affiliated with a tertiary care rehabilitation hospital. The third research trial in this dissertation (Chapter 5) used an RCT design to evaluate the impact of a specialized yoga program on pain and related variables (intensity, interference, catastrophizing), psychological factors (psychological inflexibility, anxiety, depressive symptoms, posttraumatic growth, resilience, self-efficacy, self-compassion), and mindfulness in individuals with SCI who were affiliated with a tertiary care rehabilitation hospital.

Chapter 2, which follows immediately, presents information about the qualitative data portions of this dissertation. There are two sections: the first section presents a 'researcher perspective' and the second section presents the type of analysis used to evaluate the qualitative data, as well as contextual issues. Details on the procedure for the collection of qualitative data was not included in the two of the three published manuscripts due to space limitations, and information on the methodology for the collection of qualitative data is presented in Chapters 3 and 5 as it differed slightly across these studies.

Chapter 2: Qualitative Data; Researcher Perspective and Data Analysis

Section 1: Researcher Perspective

Each of the three studies in this dissertation employed a qualitative component to supplement the quantitative data and provide greater insights into participant experience. The theoretical approach and form of analysis used is presented in this chapter and was consistent across the three studies. In qualitative research, it is important to situate the values, experiences, and biases of the researcher in the context of the research, in order to understand how these lenses may influence the qualitative research process (Elliott, Fischer, & Rennie, 1999). Reflexivity and self-reflection are valuable in promoting insight into the methodological process, opening up personal biases of the researcher, and highlighting the possible impact, perspective, and presence of the researcher. (Finlay, 2002). Therefore, this section presents my own experiences and perceptions of yoga and how this may have influenced data collection and analysis.

My interest in conducting yoga research trials emerged from my own personal yoga practice. I first began practicing yoga while studying neuroscience at Dalhousie University at the in 2004, and continued practicing yoga in Toronto prior to embarking on graduate studies in Clinical Psychology at York University in 2009. I did not enter the Master's program with the intention of conducting yoga research; however, when an initial project that aimed to evaluate pain in individuals who underwent Coronary Artery Bypass Surgery was deemed unsuitable for a Master's project, there was an opening for another type of project to be designed. Pain is a multi-modal experience, involving affective, cognitive, physiological, and nociceptive components and as such, it was possible that it could be alleviated by a practice that is also multi-faceted in

nature. There was evidence that yoga was effective in improving pain outcomes for a variety of populations who experience pain (John, Sharma, Sharma, & Kankane, 2007; Saper et al., 2009), and so my supervisor and I designed a yoga intervention for individuals with fibromyalgia. Due to the limited mobility associated with this population, it was necessary to include components of yoga beyond the physical postures, such as meditation and yoga philosophy. I travelled to Mexico to complete a Teacher Training program (200 hours), which would enable me to teach the yoga program in the research trial. Upon my return, I rented studio space at Vidya Institute, which was selected for geographical reasons and on account of its beautiful studio space that I felt would be enjoyable for participants. Through the rental of the space at Vidya, I was introduced to the studio director, Gitte Bechsgaard, and I began to study intensively with her and her now deceased teacher, Sri Krishan Mantri-ji. From 2010-2017, I studied the teachings of yoga and related philosophical texts (e.g., the Bhagavad Gītā, Patañjali's Yoga Sūtras, the Charika Samithā) and also engaged with various yogic practices. As well, I completed an additional 500 hour yoga teacher training program. During these years, my priorities shifted and reorganized as I integrated the philosophical teachings into my daily life. These teachings included instructions on how to behave in relationships, how to cultivate peace, and the application of ethical principles, such as non-harm, truthfulness, generosity of spirit, contentment, and compassion, amongst many others.

Certainly, my research questions have been informed by transformative experiences I have had through the practice of yoga. I have observed benefits in myself from the practice of the physical postures, both when I have been healthy and when I have experienced physical injury or musculoskeletal instability. In parallel, I have experienced changes to my inner nature and well-being as a result of yogic meditation practices that I have engaged with daily for the past seven

years. More importantly, however, is the manner in which I have seen yoga influence the structure of my day, my values, my level of empowerment, and my commitment to humanity. It is fair to say that the specific qualitative questions selected in the various yoga research projects I have conducted have been influenced by my own experiences with a yoga practice. For example, some of the qualitative questions used in the studies of this dissertation (see Appendix A and C), such as 'has your daily life changed, and if so, how?' and 'has your perception of your body/sense of self changed, and if so, how?' were informed by the fact that my own daily life changed, my sense of self evolved, and my perceptions of my own body and health conditions were altered as a result of yoga. Over the years, I observed myself using the tools of yoga when facing obstacles in day-to-day living, noticed a deepening in my sense of self, and also found that I developed a different relationship to my body, with a greater focus on functionality and strength, and as a vehicle for contribution in society. As well, with practice, I began to view illness and injury as a doorway into the self, rather than a loss or source of grief. These experiences with yoga as a relatively able-bodied person resulted in hypotheses about the possibilities and gains that yoga may offer to help to bolster the inner experiences of individuals with severe and impairing disabilities. Qualitative reports and quantitative results in the yoga research literature corroborated these tentative hypotheses and provided a rationale for including the qualitative questions.

As a student of Clinical Psychology, I have been trained to use theoretical models to both capture and classify psychological phenomenon. Some of these frameworks, such as models of pain and stress, account for the contributions of the physical body on psychological experiences, or the interactive nature of the body and mind. Qualitative questionnaires could potentially assist in capturing components of experience that include this mind-body interaction. Not only is it

difficult to capture the experience of yoga practice through one dimension or construct alone (e.g., mindfulness, positive affect, self-efficacy, resilience, spiritual well-being), there also remains the complication that experiences with yoga are unique and will vary across individuals. By including a qualitative component, the complexities of each person's experience would be captured, which would provide a more complete picture of the impact of yoga on individuals with severe and impairing disability.

In these research trials, I was not the yoga teacher but I did observe all the classes, and there is a possibility that my presence had an impact on the yoga intervention or the experiences of participants in the program. I did not provide assistance in a yoga teaching capacity in Study 1 or 3, but did assist in a teaching capacity for 1 of the 8 classes in Study 2, due to logistical limitations when the teacher was ill. As well, I conducted some or all of the qualitative interviews across the three studies and the biases that I hold about the benefits of yoga may have been inadvertently communicated. A person–centred approach was employed in the interviews and there was no intentional co-construction of narrative between the researcher/interviewers and participants. This approach was selected to maintain rigor and prevent researcher biases from informing the responses, especially as the questions were already somewhat suggestive in nature. Despite attempts to 'bracket' researcher perspective, a natural curiosity or enthusiasm may have been perceived by participants and interpreted as reinforcement to disclose positive experiences. In order to safeguard against the overinclusion of positive changes resulting from yoga, a question on the negative elements of the program was presented as one of the open-ended questions.

It is important to note that I was excited to share the practice of yoga with participants in a manner that is seemingly contradictory to mainstreams views of yoga as a form of physical

achievement, acrobatic contortions, body sculpting, or simplistic fitness. Although yoga may result in improved physical health, flexibility, strength, toning, and functionality, and it is meritorious to seek these gains, it is also imperative to decouple it from popular views of it as physical practice alone. The misconception of yoga as a practice only for the physically fit or healthy may deter those with physical ailments or disabilities from practice, and it was an intention of mine to design and evaluate accessible yoga programs for individuals with serious health impacts. Although the participants of all three studies had varying degrees of sensory and motor impairment, levels of independence, and comorbidities, they all faced difficulties with mobility and pain, and barriers to participation in physical activities. As this body of research sought to explore the phenomenological worlds of individuals with limited mobility, severe disability and pain who participate in a yoga program, it was expected that the results would contribute to the literature of health interventions for this population.

Section 2: Methodology and Contextual Issues

Fundamental qualitative description was employed to analyze the qualitative transcripts in each of the three studies (Sandelowski, 2000, 2010). This theoretical model was selected above other forms of qualitative methodology, such as empirical phenomenology, ethnography, narrative inquiry, conversational analysis, qualitative discourse analysis, and grounded theory. These approaches all differ on their philosophical basis but are united in a shared purpose of providing enrichment to understanding of experience (Elliott et al., 1999). Many of these models require a degree of researcher interpretive 'spin' on the data, in which the researcher is required to mover father into or even beyond the data so that the participant's description is transformed into the researcher's phenomenological description of the event (Sandelowski, 2010). By

contrast, fundamental qualitative description has benefits of being 'close' to the data in that it provides a relatively low-inference comprehensive summary of the information conveyed by the participants during the interviews. Despite this practical approach, it also requires a degree of interpretation on the part of the researcher above and beyond simplistic summarization and is done through the technique of content analysis (Sandelowski, 2010).

Qualitative content analysis is the primary methodological analysis for this theoretical model (Sandelowski, 2000). This is a dynamic analytical approach in which codes are systematically applied to data that are derived from careful reading of the data (Morgan, 1993). Each transcript was considered a *unit of analysis,* and was reviewed in full to obtain a general sense of the information provided, after which it was analyzed line-by-line and concepts were sorted according to *units of meaning/content units/coding units*. Parts of the text that focus on a specific issue were stratified according to *content area* or *clusters*. Through analysis, the text was abbreviated, through a process of distillation and condensation, in which the quantity of text is reduced but the overall quality or meaning of the text remains (Graneheim & Lundman, 2004). The *units of meaning* refer to a set of words or phrases that capture a the same central meaning and codes, categories, and themes were generated to capture these units of meaning through the process of abstraction of the data (Graneheim & Lundman, 2004). Codes are considered a heuristic device for labelling a condensed unit of meaning in descriptions provided by participants (Graneheim & Lundman, 2004). The process is dynamic in that codes and categories evolve throughout the data analysis process to ensure that no data are excluded on account of a lack of goodness of fit. In order to include all data, the codes or categories morph or broaden so that they capture all relevant meaning, or new codes are generated to account for possible outliers. Themes link underlying codes and categories in capturing content of the text and aspects

of the described experience, and can be further divided into sub-themes (Graneheim & Lundman, 2004). In summary, units of analysis (the transcripts) were reviewed through the process of condensation to create units of meaning (codes/categories) which were them classified into themes and sub-themes. Additionally, codes are counted across participants to provide a further step in interpretation by revealing patterns of the data and proportions of participants with a particular experience (Morgan, 1993).

In each study, two research team members independently read and coded each transcript and resolved any points of disagreement in coding through discussion. The analysts for each study were as follows: Study 1: Kerry Kuluski and Kathryn Curtis; Study 2: Claire Wicks and Kathryn Curtis; and Study 3: Candice Stoliker and Kathryn Curtis. The purpose of having multiple researchers for each study helped to reduce any biases, lenses, and unconscious motives that may have influenced interpretation, and thereby increased transparency and 'closeness' of the data. As well, there were multiple interviewers for the qualitative interviews in each study. Interviewers for each study were as follows: Study 1: Kathryn Curtis, Claire Wicks, and Mahsa Nisseri; Study 2: Kathryn Curtis; and Study 3: Kathryn Curtis, Claire Wicks, Meaghan Ferguson, and Candice Stoliker. Of the 6 interviewers and analysts, to my knowledge 3 have a regular yoga practice. Although the presence of multiple analysts and interviewers with a regular yoga practice may have confounded attempts to reduce favourable biases toward yoga, there were three individuals who did not.

Chapter 3, which follows next, consists of three sections: the first section presents the objective and hypotheses; the second section presents the published manuscript; and the third section presents the qualitative data procedure and results.

Chapter 3: Study 1, Pilot Study Evaluating Yoga for Complex Chronic Disease and Disability

Section 1: Objective and Hypotheses

Objective.

The objective of this pilot research project was to evaluate pain, psychological, and mindfulness constructs in the context of a specialized yoga program for individuals with CCDD who were undergoing CCC or MR at BH. We sought the expert opinion and guidance of staff and professionals at BH regarding research study design to optimize the yoga program and make it most useful and impactful for this population.

Hypotheses.

This study had one primary hypothesis (see point 1 below) and 2 secondary hypotheses (see points 2-3 below):

Specific hypotheses were:

1. Scores on pain, pain catastrophizing, stress, anxiety, depressive symptoms, and experiences of injustice would decrease from pre- to post-intervention.

2. Scores on mindfulness, self-compassion, and spiritual well-being would increase from pre- to post-intervention.

3. Yoga would positively impact the lived experience of individuals receiving CCC or MR with respect to perceptions of body, health, sense of self, future and purpose in life, as well as experiences of daily life.

Section 2: Published Article

The following study has been published in Evidence-Based Complementary and Alternative Medicine, an open-access, online journal distributed under the Creative Commons Attribution License which permits its reproduction in the present dissertation.

The list of yoga postures used in Study 1 is presented in Appendix A, List of Yoga Postures Used in the Yoga Program.

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Research Article

Evaluation of a Specialized Yoga Program for Persons Admitted to a Complex Continuing Care Hospital: A Pilot Study

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Introduction. The purpose of this study was to evaluate a specialized yoga intervention for inpatients in a rehabilitation and complex continuing care hospital. *Design*. Single-cohort repeated measures design. *Methods*. Participants ($N = 10$) admitted to a rehabilitation and complex continuing care hospital were recruited to participate in a 50–60 min Hatha Yoga class (modified for wheelchair users/seated position) once a week for eight weeks, with assigned homework practice. Questionnaires on pain (pain, pain interference, and pain catastrophizing), psychological variables (depression, anxiety, and experiences with injustice), mindfulness, self-compassion, and spiritual well-being were collected at three intervals: pre-, mid-, and post-intervention. *Results*. Repeated measures ANOVAs revealed a significant main effect of time indicating improvements over the course of the yoga program on the (1) anxiety subscale of the Hospital Anxiety and Depression Scale, $F(2, 18) = 4.74$, $p < .05$, and $\eta_p^2 = .35$, (2) Self-Compassion Scale-Short Form, $F(2, 18) = 3.71$, $p < .05$, and $\eta_p^2 = .29$, and (3) Magnification subscale of the Pain Catastrophizing Scale, $F(2, 18) = 3.66$, $p < .05$, and $\eta_p^2 = .29$. *Discussion*. The results suggest that an 8-week Hatha Yoga program improves pain-related factors and psychological experiences in individuals admitted to a rehabilitation and complex continuing care hospital.

1. Introduction

Yoga is an ancient mind-body practice that is embedded in Vedic traditions dating back to 3000 BC [1] and which is being applied in developed countries as a broad remedy to attenuate health-related symptoms in clinical populations [2, 3] across institutional, community, commercial, and private settings. Yoga is traditionally understood as cultivating concentrative awareness and a unified experience of the self through physical postures (āsana), breathing exercises (prāṇāyāma), inner awareness (pratyāhāra), concentration (dhāraṇā), and meditation (dhyāna), with consequent improved health through a separation process from afflictive cognitive, emotional, behavioural, and autonomic patterns and a shift towards adaptive coping skills [4, 5].

Yoga is garnering attention for its ability to simultaneously address multiple body systems (e.g., circulatory, neuroendocrine, musculoskeletal, respiratory, viscerosomatic, and immunological) through a dynamic and bidirectional process consisting of both top-down and bottom-up constituents and to yield benefits in well-being and symptom reduction [3, 5]. Burgeoning interest in yoga as a therapeutic intervention for a variety of health conditions has resulted in an expansion of research over the past decade, with the volume of publications increasing by threefold with up to 312 randomized controlled studies noted in 2013 [6, 7]. There are a plethora of lineages and schools of yoga that are evaluated in yoga research trials, but the style of yoga (e.g., aṣṭāṅga, iyengar, and hatha) does not impact the odds of producing positive outcomes for different conditions [8]. Across many of

these studies, yoga is extolled for its many benefits. However, the literature is plagued by studies of poor methodological quality and there has been a call for improving the caliber of research in this area [9].

There is evidence that yoga is effective in the treatment of a variety of acute and chronic conditions [9] either as a stand-alone treatment or as an adjuvant therapy, including low back pain [10, 11], arthritis [12], rheumatic disease and fibromyalgia [13, 14], diabetes [15, 16], cancer and related fatigue [17–21], stroke and related disability [22, 23], sleep disorders [24], renal disease [25, 26], hypertension [27, 28], asthma [29, 30], chronic obstructive pulmonary disease (COPD) [31], psychiatric conditions [32], obesity [33], and neurological conditions [34, 35]. Although there is an abundance of research evaluating the impact of yoga on disease-specific symptoms or quality of life for many chronic conditions, to date there has not been one trial evaluating the effects of a yoga intervention on individuals who are receiving care or rehabilitation for complex chronic disease and disability (CCDD).

CCDD is a term that identifies individuals who have been diagnosed with multimorbidities that affect psychological, social, physical, and vocational functioning and require ongoing health care resource utilization [36–38]. Individuals with complex health conditions have been identified as unique in terms of their specific health care needs and health-related experiences [36]. Although the disease combinations reported in multimorbidity are diverse, the most common diagnoses are diabetes, stroke, hypertension, cancer, arthritis, asthma, fractures, the presence of an artificial knee or hip, fatigue, multiple sclerosis, demyelinating diseases of the central nervous system, gonarthrosis, ataxia, COPD, dependence on renal dialysis, malignant neoplasm of breast/prostate, depressive episodes, and pure hypercholesterolemia [39, 40]. Consistent across studies of this population is the severity of the impact of having multiple conditions [41]. Patients with CCDD have an average of five health conditions (comorbidities) [40] and frequently reported pain, weakness, illness-related symptoms, functional challenges (mobility, activities of daily living, equipment devices, etc.), symptoms of anxiety and depression, and disruptions in independence, recreational activities, occupation, social roles, and self-identity.

Multimorbidity has been associated with low socioeconomic status, female gender, and older age in both longitudinal and cross-sectional studies, with prevalence and incidence rates in older age reported at 55% and 12–33%, respectively, and prevalence rates in young-middle age at 11.3–15.4% [42–45]. Multimorbidity is a complex and heterogeneous disease state, with many of the most prevalent conditions being of global concern, and is increasingly becoming the norm rather than the exception, resulting in high health care resource use [45, 46]. In Canada, 42% of total direct medical care expenses are allotted to the treatment of chronic diseases [47], with up to $52,661 per patient spent on average for the last year of life, in part due to inpatient and long-term care costs [48]. Despite the clear priority of the medical community to address the needs of individuals with chronic disease, the orientation of the health care system as an acute-care focused model means that care for individuals with chronic disease is often ineffective, leaving those with many chronic conditions underserviced [49].

A structural shift towards care that is not disease/injury focused but emphasizes addressing many needs at once has been recommended [50, 51]. Understanding the relationships between physical, psychological, and social factors of health in multimorbidity has been identified as necessary for creating effective treatment [38, 52]. A remodeling of chronic disease services has been proposed to create interventions that harmoniously integrate patient-centered and systemic factors and that also target risk factors, such as depression or functional ability, with the end goal of improving patient self-efficacy, functional health status, health-related behaviours, and psychological well-being [49, 53]. Despite an increase in research over the past two decades on multimorbidity, there is still limited research on effective interventions to adequately service this population [53, 54], which highlights a need for programs that are designed to address the needs of individuals who are managing multiple intersecting health impacts of a chronic nature.

Given the evidence supporting the use of yoga for many of the common primary and secondary diagnoses of patients with CCDD (e.g., musculoskeletal conditions, multiple sclerosis, hypertension, arthritis, renal disease, depression, diabetes, COPD, cholesterol levels, and breast and prostate cancer), it is possible that yoga may be able to address many of the multiple health needs these individuals report as being important [40]. Other frequently reported symptoms (e.g., pain, fatigue, emotional upset, nausea, and difficulty breathing) and facets of living that are disrupted (e.g., mobility, activities of living, and social well-being) have also been shown to improve with yoga practice [2, 19, 21, 55, 56]. Moreover, yoga provides a lasting behavioural skill set that increases confidence and self-efficacy and shows maintenance of functional and coping gains in chronic pain patients at follow-up [57]. It can be used in the treatment of chronic conditions for both low- and high-income populations, is associated with treatment adherence in sedentary adults, and holds promise as a cost-effective treatment for chronic conditions [58–61]. Complementary and alternative therapies such as yoga have been recommended for integration into clinical health psychology settings in order to more broadly address well-being, spirituality, multiple health problems, dissatisfaction with orthodox medicine, and disease prevention [62].

Although there is evidence that yoga provides mental and physical health benefits for many of the disease states and psychosocial impacts that are prevalent in individuals with multimorbidity, there have been no studies evaluating its use for this population. Medical rehabilitation and complex continuing care support tend to focus on addressing physical ailments and neglect integrating mental health support. Yoga is an example of a strategy that addresses both; thus it may impart benefits in multiple areas of health, rendering it particularly useful for this population. Hospital and tertiary care settings typically implement evidence-based practice, so there is a need for information regarding the benefits and safety of yoga when used in the treatment of individuals with CCDD or multimorbidity.

Table 1: Demographics of the sample ($N = 10$).

Demographic	N (%)/M (sd)
Age (years)	63.1 (16.6)
Height (cm)	163.6 (15.4)
Weight (kg)	70.7 (17.1)
Race/ethnicity	
African Canadian	2 (20%)
European (Italian/Croatian)	2 (20%)
Caucasian	6 (60%)
Socioeconomic class	
High	1 (10%)
Middle-high	1 (10%)
Middle	1 (10%)
Middle-low	2 (20%)
Low	5 (50%)
Level of education ($n = 9$)	
Grade school	2 (22.2%)
High school	2 (22.2%)
University/college	5 (55.6%)
Postgraduate school	0 (0%)

This study evaluated the impact of a specialized yoga program on pain, psychological, functional, and spiritual constructs in individuals receiving complex continuing care or medical rehabilitation. Given the complex presentation of impacts for this population, multiple measures were used to fully explore the possible effects of yoga across various aspects of experience. The study used a pilot cohort study design to test the following hypotheses: (1) scores on measures of pain, pain catastrophizing, stress, anxiety, depression, and experiences of injustice will decrease from pre- to post-intervention and (2) scores on mindfulness, self-compassion, and spiritual well-being will increase from pre- to post-intervention.

2. Materials and Methods

2.1. Participants. In order to be included in the study, participants had to be inpatients at Sinai Health System (Bridgepoint Hospital (BH) Site), be able to understand and speak English, and be cognitively able to understand instructions. Exclusion criteria included a regular yoga practice in the six months prior to the commencement of the study, an expected discharge date before the completion of the yoga program, or moderate cognitive impairment as indicated by a cognitive screen done by BH care team. Participants either were wheelchair users or were comfortable doing yoga from a seated position.

Demographic information and clinical characteristics of the sample are summarized in Table 1. Participants had all been admitted to BH in 2014 and were receiving either complex continuing care (CCC; $n = 9$) or medical rehabilitation (MR; $n = 1$). The one patient that was admitted for MR was informally transferred to CCC partway through the hospital stay for more intensive care. Examination of hospital records across a range of assessment dates indicated that participants had different levels of independence for tasks of daily living and mobility, such as transferring from a bed to a wheelchair. Information recorded within the hospital system is different for the complex continuing care and medical rehabilitation streams.

Both males ($n = 4$) and females ($n = 6$) participated in the yoga program. Height and weight were taken from hospital records for participants receiving CCC and if multiple weight assessments were provided, the weight assessment time closest to the start date of the yoga program was used. Weight and height were taken from self-report data for the participant receiving MR; secondary conditions were not reported for this patient. Participants had been diagnosed with at least one medical condition (see Table 2) and on average 7.6 ± 2.8 conditions. Although most conditions were accompanied by a formal disease diagnosis, some documented conditions were not necessarily accompanied by diagnoses (e.g., weight issues, allergies, pain, and instability). Participant use of various pain treatments (pharmacological, natural health products, physical treatments, psychological treatments, and medical interventions) are displayed in Table 3. The study researchers worked with hospital staff to obtain medical clearance notes for all participants, indicating that it was safe for participants to participate in an eight-week yoga program. Participants did not receive financial compensation for participating in the study.

2.2. Procedure. The research protocol was reviewed and approved by the Human Participants Review Committee at York University and by the Joint Bridgepoint Health, West Park Healthcare Centre, Toronto Central Community Care Access Centre (CCAC), and Toronto Grace Health Centre Research Ethics Board.

2.3. Research Design. This prospective, pilot study consisted of two parts: a Codesign Phase and a Research Intervention Phase. The Codesign Phase involved consultation with BH staff (Therapeutic Recreation staff, research scientists, the Chair of Complex Chronic Disease Research, the Director of Professional Practice, and a liaison to the research ethics board) to discuss the best approach to the yoga program development, delivery, and evaluation so that it would contribute to meeting the complex needs of the patients. As depicted in Figure 1, the Research Intervention Phase consisted of several components: an information session, yoga classes, follow-up meetings, and administration of self-report questionnaires. Questionnaires concerning pain and related variables, psychological factors, and mindfulness were administered at three time (T) points: pre- (T1), mid- (T2), and postintervention (T3). There were no subsequent data collection points in the time following the yoga intervention. The information session was held seven days before the yoga program began. The yoga program ran for eight weeks (one class/week) and the follow-up meetings took place after the final class and in the following few days. The information session and yoga classes were held in one of two auditoriums at the hospital.

Table 2: Primary and secondary conditions by participant ($N = 10$).

Participant	Primary diagnoses	Secondary diagnoses
1	Multiple sclerosis	Instability (report of having fallen).
2	End stage renal disease	Diabetes, hypertension, ischemic disease (unspecified), gastrointestinal issues, renal failure, moderate pain (less than daily), general instability (report of having fallen).
3	Klippel-Feil syndrome	Asthma, emphysema, moderate pain (daily), general instability (report of having fallen).
4	Superficial injury	Hypotension, cerebrodisease, arthritis, Parkinson's disease, asthma, moderate pain (both daily and less than daily), general instability (report of having fallen).
5	Cervical spondylosis	Osteoporosis, hemiplegia, anxiety, allergies, anemia, gastrointestinal issues, pneumonia, moderate pain (daily), general and acute instability (report of having fallen), skin issues (pressure ulcers, rash).
6	Intracranial hemorrhage (NOS, nontraumatic)	Hypertension, cardiovascular disease, aphasia, cerebrodisease, hemiplegia, allergies, pneumonia, urinary tract infection, weight issue, edema, moderate pain (daily), general and acute instability.
7	Hyperkalemia	Diabetes, arthritis, pneumonia, moderate pain (daily), report of having falling.
8	Neuromuscular bladder dysfunction (NOS)	Hypothyroidism, sclerosis (type not indicated), depression, mild pain (daily), general instability, skin issues (pressure ulcers, rash, desensitized skin).
9	Syncope and collapse	Hypertension, osteoporosis, depression, emphysema, gastrointestinal issues, moderate pain (less than daily), report of having fallen, anxiety.
10	Neuromyelitis optica/Devic's disease	Hemiplegia, sclerosis, depression, gastrointestinal, urinary tract infection, moderate pain (daily), general instability, skin issues (rash).

Table 3: Pain medications and pain treatments previously or currently used ($N = 7^*$).

Pain medications and treatments	N (%)	Participant number
Pharmacological medications (e.g., opioid-based medications, acetaminophen, and antidepressants)	7 (100%)	1, 3, 4, 5, 7, 8, 10
Natural health products (e.g., supplements and vitamins)	5 (71.43%)	1, 3, 4, 5, 8
Physical treatments (e.g., massage, acupuncture, physiotherapy, and exercise)	5 (71.43%)	1, 3, 4, 5,8
Psychological treatments (e.g., meditation, psychotherapy, distraction, and relaxation)	3 (42.86%)	3, 4, 8

Note. *Three participants did not record the use of pain medications or treatments.

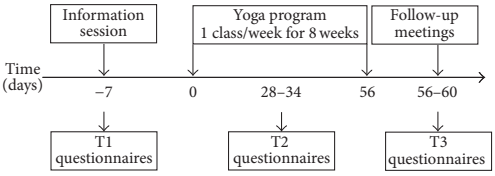

Figure 1: Time sequence of the study intervention. The information session was held seven days before the yoga program began. The yoga program was held once weekly for 8 weeks. Questionnaires measuring pain, pain-related variables, psychological factors, and mindfulness were evaluated at three time points: T1, T2, and T3.

2.4. Information Session and Data Collection. Interested individuals were informed about the yoga study by hospital staff (Therapeutic Recreation team members and support staff) and were screened for eligibility. Eligible participants attended the information session (T1) where they were given information about the investigators, the content of the yoga program, expectations for attendance and commitment, possible initial increases in pain due to exertion, and the homework component. Interested individuals had the opportunity to ask questions or voice concerns and those who decided to participate completed the consent process. After written informed consent was obtained, participants were provided with a canvas tote folder, which included an MP3 player with the homework audio files (see yoga program description), a copy of the consent form for their records, and a handwritten instruction guide to using the MP3 player with accompanying illustrations. Participants filled out a form with questions regarding demographic information, health history and current health status, and the questionnaire package. At T2, participants had the option of remaining after the yoga class to fill out questionnaires or taking the questionnaires back to their hospital room to fill out prior to the following class. At T3, participants filled out the questionnaire package after the final class.

2.5. The Yoga Program. The specialized yoga program consisted of an integrated approach to Hatha Yoga: postures (āsana), breath awareness exercises (prāṇāyāma), concentrative, meditative, and relaxation practices (dhāraṇā, dhyāna),

Table 4: Yoga philosophy concepts by class.

Class number	Concept	Explanation
1	Witness consciousness and ahimsā (nonviolence); Sūtra 2.35.	Practicing "being with" challenging experiences without pushing them away or clinging to personal narratives. Practicing in a way that is safe and supportive.
2	Satya (truthfulness); Sūtra 2.36.	Honestly examining one's experience to better understand one's "starting point" and using yoga practice as a springboard for positive change.
3	Breath awareness to balance the nervous system and calm the mind; Sūtra 1.34.	Pain management through relaxation, training the attention to see tension patterns in the body, and using imagery and visualization.
4	Sthira sukham āsanam; Sūtra 2.46.	Finding a balance between steadiness/stability/effort with ease/joy/relaxation.
5	Ekā gra (one pointed concentration); Sūtra 1.32.	Training attention and concentration by returning to a point of focus repeatedly.
6	Contemplation on the heart; Sūtra 1.36.	The heart as a resource, refuge, and source of inner luminosity.
7	Contemplation of kośas (sheaths/layers).	Five sheaths of the self: physical (annamaya), breath (prāṇāmaya), mind (manomaya), wisdom (vijñānamaya), and joy (ānandamaya). Practicing experiencing parts of the self without identifying with them.
8	Śavasana and the kośas.	Consolidation of all concepts. Cultivation of awareness of the layers of the self and a deeper part that can rest back and witness.

and yoga philosophy (jñāna) [63–65]. One of the most ancient scriptures of Hatha Yoga outlines yoga as a purificatory practice that balances the activities and processes of the physical body, the mind, and the overall energy level, in order to cultivate health, self-awareness, and inner development [65]. Hatha Yoga was selected as an appropriate form of yoga for individuals with chronic conditions and mobility restrictions as it is gentle and can be easily modified. The yoga philosophy component (see Table 4) was based on relevant contemplative and reflective practices from Patañjali Yoga Sūtras that focused on self-study, personal development, observances, yamas (ethical discipline), and attitudes of acceptance, among others [4, 64, 66]. Concepts found in classical scripture, such as the kośas theory of self, are being integrated in protocols for yoga interventions for chronic illness with a mind-body component [67]. The classes were one-third āsana, one-third relaxation training, and one-third yoga philosophy. The class format, structure, and content were designed in accordance with the yoga literature. A BH Recreation Therapy Assistant was present at each session. All participants practiced from a seated position, using either a wheelchair or a table chair to allow for uniform practice of the āsanas across participants.

Participants were provided with two recordings and were instructed to practice using the MP3 player twice a week. The first recording was a guided body scan awareness practice (~30 minutes) and the second recording was an āsana practice (~15 minutes). The participants were not given the second recording until they were familiar with the yoga āsanas and the teacher decided that they were safe to practice them on their own.

2.6. Measures

2.6.1. Brief Pain Inventory-Short Form (BPI-SF) [68]. The BPI-SF is a 9-item self-report questionnaire that measures various aspects of pain and pain interference with daily activities. The Brief Pain Questionnaire [69] and the Brief Pain Inventory [70, 71] were originally developed to evaluate cancer-related pain and have since been validated for other types of pain [72, 73]. In the BPI-SF, individuals are queried on pain history, are asked to visually depict pain locations on a human body diagram, and are asked to indicate best, worst, average, and current pain levels according to 11-point Likert scales, ranging from 0 (*no pain*) to 10 (*pain as bad as you can imagine*). Participants are also queried about pain medications and treatments and the perceived effectiveness of those medications. Finally, individuals respond to items regarding how pain interferes with seven domains of functioning: general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life, according to 11-point scales ranging from 0 (*does not interfere*) to 10 (*completely interferes*).

The BPI has strong internal consistency (Cronbach's α = .85 and .88 for the intensity and interference scales, resp.), adequate construct validity (scores on the interference scale correlate with other pain disability measures) and is sensitive to treatment [70]. The BPI-interference items have been used in studies evaluating pain in individuals with SCI [74, 75] and have been recommended for use in this population, though item 9c, which refers to "Walking Ability," should be changed to "Ability to Get Around" [76]. It has excellent internal consistency ($\alpha > .90$) and is positively associated with pain intensity ($r > .60$) [77].

2.6.2. Pain Catastrophizing Scale (PCS) [78]. The PCS is a 13-item self-report questionnaire that measures catastrophic thinking in relation to experienced or anticipated pain. Participants are asked to read each item and indicate the extent to which they experience certain thoughts and feelings when experiencing pain by selecting a number from 0 (*not at all*) to 4 (*all the time*). Scores range from 0 to 52, with higher scores reflecting higher levels of pain catastrophizing. The PCS yields a total score and three subscale scores assessing rumination (focus on pain sensations), magnification (exaggerating the threat value of pain sensations), and helplessness (perceiving oneself as unable to cope with pain symptoms). The PCS has high internal consistency (coefficient α: total PCS = .87, rumination = .87, magnification = .66, and helplessness = .78) [78].

2.6.3. Perceived Stress Scale (PSS) [79]. The PSS is a 10-item self-report questionnaire that measures symptoms of stress over the past month, in relation to life events and relationships. Participants indicate how much they are experiencing their life as unpredictable and uncontrollable and how much they have felt overloaded. Each item is rated on a 5-point scale, ranging from 0 (*never*) to 4 (*very often*), with a highest possible score of 40, such that higher scores are indicative of higher levels of stress. It correlates well with other measures of stress, such as life events, and depression and anxiety scales and has satisfactory internal reliability (α = .78–.82) and test-retest reliability (r = .55–.85) [79, 80].

2.6.4. Hospital Anxiety and Depression Scale (HADS) [81]. The HADS is a 14-item self-report questionnaire that measures symptoms of anxiety (7 items) and depression (7 items). For each item, participants are asked to select one from among four possible choices (scored from 0 to 3) that best describes how they have been feeling over the past week. The HADS yields an anxiety (HADS-A) and a depression (HADS-D) subscale score, each with a maximum total score of 21, where higher scores indicate higher levels of anxiety and depression. Scores of 8–10 are considered cut-off points that are clinically meaningful for symptoms of anxiety and depression [81]. Internal consistency is high for both the HADS-A (α = .83) and HADS-D (α = .82) subscales [82]. Concurrent validity of the HADS is very good, as measured by correlation coefficients of between .62 and .73 for the HADS-D with various well-validated depression scales and correlation coefficients of between .49 and .81 for the HADS-A with various well-validated anxiety measures [82].

2.6.5. Injustice Experiences Questionnaire (IEQ) [83]. The IEQ is a 12-item questionnaire that evaluates feelings and thoughts of perceived injustice and severity of loss in relation to injury or pain. This scale is designed to evaluate cognitive appraisals that contribute to pain-related occupational disability. Individuals answer each item using a 5-point scale, ranging from 0 (*never*) to 4 (*all the time*). This scale has a total score and two subscales, blame/unfairness and severity/irreparability of loss. The total scale has good internal consistency (α = .92) and all items correlated above .05 with the total score [83]. This scale has been correlated with pain severity, pain catastrophizing, fear of movement, perceived disability, and depression (r = .54–.75, $p < .01$), indicating good construct validity. Cross-sectional regression analysis has shown good discriminant validity in that IEQ contributes to the variance of the predication of pain severity (β = .44, $p < .05$) [83]. Test-retest variability of the IEQ is good and scores across time are stable (r = .90, $p < .01$); authors note that the test-retest scores were more stable than scores on measures of pain and related constructs (e.g., PCS, Pain Disability Index, and McGill Pain Questionnaire) [83].

2.6.6. Five-Facet Mindfulness Questionnaire-Short Form (FFMQ-SF) [84]. The FFMQ-SF is a 24-item version of the original 39-item FFMQ and has been validated in individuals with depression, anxiety, and fibromyalgia [84]. It is a self-report questionnaire that measures levels of mindfulness according to five facets, which have acceptable model fit with the five-factor structure of the FFMQ. Those facets are observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience. Participants respond to each item by selecting the number that is "most generally true" of his/her experience, on a scale of 1 (*never or rarely true*) to 5 (*very often or always true*). Total scores range from 0 to 120 and higher scores indicate greater levels of mindfulness. The FFMQ is based on a factor analytic study of five independently developed mindfulness questionnaires, with good internal consistency and construct validity [85, 86]. Total facet scores of the FFMQ-SF are highly correlated with the original version, r = .89, .89, .92, .96, and .95, for observing, describing, acting with awareness, nonjudging, and nonreactivity, respectively [84]. The correlation alphas are all above the defined criterion of .7 and all intercorrelations between facets and with other constructs are very virtually the same as the FFMQ. All the facets of the FFMQ-SF are sensitive to change and had moderate-large effect sizes [84].

2.6.7. Self-Compassion Scale-Short Form (SCS-SF) [87]. The SCS-SF is a self-report 12-item version of the original 26-item questionnaire [88] that measures levels of self-compassion. Self-compassion, as measured by this scale, is defined as the ability to hold one's feelings of suffering with a sense of warmth, security, or concern [87]. This short form has been demonstrated to have a unidimensional construct of self-compassion and also a multidimensional construct consisting of 6 subscales including self-kindness, self-judgement, common humanity, isolation, mindfulness, and overidentified; however, it is not recommended to use subscales for the short form version. The questionnaire queries respondents to indicate "how I typically act towards myself in difficult times," according to a scale of 1 (*almost never*) to 5 (*almost always*). This scale has been shown to have adequate internal consistency (Cronbach's $\alpha \geq .86$ for three different samples) and good correlation with the full version ($r \geq .97$ for three samples). The total score for the short form is calculated by dividing the total score by 12 (for each item) to produce a mean score (personal communication with Kristen Neff, April 19, 2016).

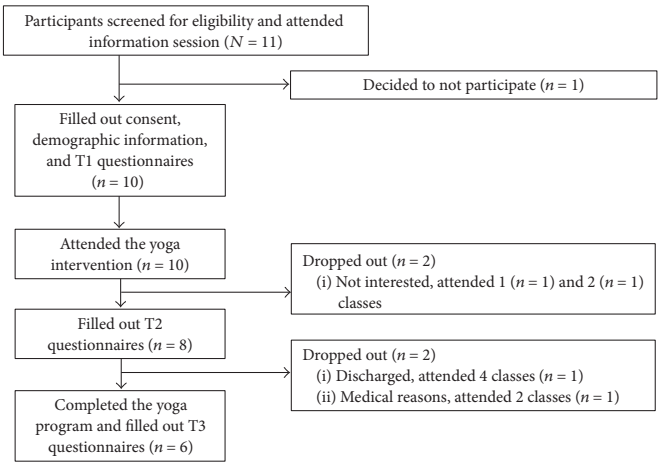

Figure 2: Participant flow through the study.

2.6.8. Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being (FACIT-SpWB) [89]. The FACIT-SpWB is a 12-item self-report questionnaire that evaluates experiences of spirituality in individuals with chronic illnesses. The original scale has a total score and two subscales: meaning/peace and faith, although confirmatory factor analysis has validated the three-factor model in which meaning and peace are unique subscales [90]. Questions query themes of harmony and peacefulness and a sense of strength and comfort in one's beliefs. Participants answer each item using 5-point Likert scale, from 0 (*not at all*) to 4 (*very much*). This scale has good internal consistency for the overall index and for the two subscales (α = .81–.88). This scale also shows good validity; both the total scale and each subscales were positively correlated with measures of quality of life in cancer patients (Functional Assessment of Cancer Therapy-General) and negatively with measure of mood (Profile of Mood States) [89].

2.7. Data Analysis. Statistical Analysis was performed using SPSS Version 23 and SAS Version 94. Exploratory analysis was conducted to evaluate missing data and assumptions of normality. Raw data were evaluated for skew and kurtosis. All self-report measures were assessed for normality using the Shapiro-Wilk test. The self-report data were analyzed using repeated measures ANOVAs (T1, T2, and T3) and Bonferroni post hoc analysis in the presence of a significant main effect of time. Sphericity was evaluated using Mauchly's Test of Sphericity and, in the case of violations, Huynh-Feldt adjustments were used. Simple mediation analysis was conducted using a bootstrapping approach (2,000 resamples), as recommended for small sample sizes which may have violations of normality [91], to evaluate the mediating effect of total SCS scores at T2 on the relationship between HADS-A scores at T1 and T3.

3. Results

3.1. Preparation of Data. Data were analyzed by a protocol compliance (PC; $n = 6$) and intention-to-treat approach (ITT; $N = 10$). Although one of the participants had missed yoga classes 3 and 4 due to medical reasons, data were collected for this participant at T2 as they had not formally withdrawn from the study by that time. Therefore, for ITT analysis, data were carried forward from T1 for two participants and from T2 for two participants. One participant did not fill out the HADS questionnaire at T1, so T2 scores for this participant were used as a baseline score.

Data were explored for assumptions of normality. Values of kurtosis and skewness for all total scale scores at each time point were converted to z-scores for both PC and ITT data. At T1, all were within normal limits (<|1.96| at $p < .05$) except BPI-3 (significant skew). For PC data, all were within normal limits (<|1.96| at $p < .05$) except BPI-3 at T3 (significant kurtosis and skew) and BPI-5 at T3 (significant skew). For ITT data, all were within normal limits (<|1.96| at $p < .05$) except BPI-3 at T3 (and significant skew) and SCS-SF at T3 (significant skew). Similarly, the Shapiro-Wilk test revealed that all total scale scores were normal at $p < .05$, with the exception of violations of normality for BPI-3, $W(10) = .81$, $p < .05$, and BPI-6 at T1, $W(10) = .84$, $p < .05$, BPI-3-PC at T2, $W(8) = .80$, $p < .05$, BPI-3-PC at T3, $W(5) = .55$, $p < .05$, BPI-3-ITT at T3, $W(10) = .81$, $p < .05$, BPI-4-PC at T3, $W(5) = .75$, $p < .05$, BPI-4-ITT at T3, $W(10) = .84$, $p < .05$, BPI-5-ITT at T3, $W(10) = .81$, $p < .05$, and SCS-SF-total-ITT at T3, $W(10) = .74$, $p < .05$. Table 5 shows the means and sds for each measure across the three time points, as well as significant p values and effect sizes.

3.2. Demographic and Clinical Variables. Figure 2 shows the flow of participants through the study, which ran from October 28 to December 16, 2014. Eleven participants were

Table 5: Mean (sd) values for pain, psychological, and mindfulness variables across time, using Intent-to-treat sample ($N = 10$).

Measure	Preintervention (T1)	Midintervention (T2)	Postintervention (T3)	Significance (p value)
BPI-SF-3	6.90 (3.14)	6.80 (2.66)	6.90 (2.81)	ns
BPI-SF-4	4.50 (3.57)	3.60 (3.20)	2.70 (2.54)	ns
BPI-SF-5	5.20 (3.49)	4.50 (2.95)	5.00 (2.91)	ns
BPI-SF-6	6.80 (3.33)	5.30 (3.71)	4.60 (3.47)	ns
BPI-9-SF-total	29.10 (21.27)	23.70 (16.40)	25.50 (17.82)	ns
PCS-total	25.30 (15.62)	21.30 (14.77)	19.30 (12.19)	.099
PCS-helplessness	11.40 (8.58)	9.20 (8.20)	8.70 (6.45)	ns
PCS-magnification	4.50 (3.72)	2.70 (3.74)	2.40 (2.59)	.047[b]
PCS-rumination	9.40 (5.06)	9.60 (4.70)	8.20 (4.98)	ns
PSS	20.20 (7.83)	19.00 (8.27)	15.70 (8.17)	ns
IEQ-total	23.50 (7.11)	20.10 (9.55)	21.10 (11.49)	ns
IEQ-blame/unfairness	10.20 (4.13)	8.10 (4.46)	8.60 (6.10)	ns
IEQ-severity/irreparability	13.30 (4.35)	12.00 (5.91)	12.50 (6.00)	ns
HADS-A	9.00 (5.64)	7.70 (5.19)	6.50 (4.38)	.022
HADS-D	6.70 (4.99)	5.70 (3.83)	5.80 (4.05)	ns
FFMQ-SF-total	84.40 (7.66)	86.60 (10.05)	87.40 (12.40)	ns
FFMQ-SF-observing	15.70 (2.16)	16.80 (2.20)	16.80 (2.15)	ns
FFMQ-SF-describing	19.50 (2.64)	19.10 (3.87)	19.10 (4.09)	ns
FFMQ-SF-acting with awareness	18.10 (1.79)	19.60 (3.06)	18.60 (4.20)	ns
FFMQ-SF-nonjudging	16.90 (4.18)	16.70 (4.37)	17.10 (5.02)	ns
FFMQ-SF-nonreactivity	14.20 (2.20)	14.40 (3.10)	15.80 (4.87)	ns
SCS-SF	3.28 (0.77)	3.57 (0.63)	3.44 (0.58)	.047[a]
FACIT-SpWB-total	33.80 (8.13)	35.00 (9.01)	36.00 (7.45)	ns
FACIT-SpWB-faith	11.80 (4.57)	11.00 (5.29)	12.00 (5.29)	ns
FACIT-SpWB-meaning	12.70 (2.45)	13.50 (2.84)	12.70 (2.16)	ns
FACIT-SpWB-peace	9.30 (3.62)	10.50 (2.55)	11.30 (2.50)	ns

Note. Greenhouse-Geisser adjusted F-tests for significant main effects of time were conducted for SCS-SF.
Note. BPI-SF: Brief Pain Inventory-Short Form, PCS: Pain Catastrophizing Scale, PSS: Perceived Stress Scale-10 Items, IEQ: Injustice Experiences Questionnaire, HADS-A: Hospital Anxiety and Depression Scale-Anxiety, HADS-D: Hospital Anxiety and Depression Scale-Depression, FFMQ-SF: Five-Facet Mindfulness Questionnaire-Short Form, SCS-SF: Self-Compassion Scale-Short Form, FACIT-SpWB: Functional Assessment of Chronic Illness Therapy-Spiritual Wellbeing.
Note. [a]$p < 0.1$ for T1 versus T2; [b]$p < 0.1$ for T1 versus T3.

recruited by hospital staff and attended the information session, 10 of whom provided consent, filled out T1 questionnaires, and participated in at least one class of the yoga program. One participant decided not to participate after learning more about the questionnaire component of the research study. Data for eight and six participants were obtained at T2 and T3, respectively.

3.3. Yoga Program Attendance. Of the 10 participants who started the yoga program, six (60%) completed it. Three participants attended 1-2 classes and withdrew for personal or medical reasons, while one participant attended 4 classes, after which she withdrew as she was discharged early from the hospital. The mean ± sd number of yoga classes attended for all participants who entered the program ($N = 10$) was 3.72 ± 2.54 (out of 8 classes) and the mean ± sd number of yoga classes attended for all participants who completed the program ($n = 6$) was 6.83 ± 0.75 (out of 8). The mean ± sd number of participants who did some homework each week (listened to a recording 1–4 times) was 4.0 ± 1.83.

3.4. Treatment Results

3.4.1. Pain and Related Variables, Psychological Factors, and Mindfulness. Repeated measures ANOVAs did not reveal significant changes in any variable across time for the PC analyses. All analyses are reported according to the ITT principle as outlined above. Repeated measures ANOVAs revealed a significant main effect of time for HADS-A, $F(2, 18) = 4.74$, $p < .05$, and $\eta_p^2 = .35$, for SCS-SF-total (Greenhouse-Geisser adjusted F-test), $F(2, 18) = 3.71$, $p < .05$, and $\eta_p^2 = .29$, and for PCS-magnification, $F(2, 18) = 3.66$, $p < .05$, and $\eta_p^2 = .29$. Bonferroni comparisons revealed a trend for improvement from T1 to T2 for SCS-SF-total, $p < .07$, and for PCS-magnification from T1 to T3, $p = .08$. A repeated measures ANOVA also revealed a trend of improvement for main effects of time for PCS-total, $F(2, 18) = 2.63$, $p = .099$, and $\eta_p^2 = .23$. Individual score trajectories for scales with significant changes or trends for improvement are shown in Figure 3.

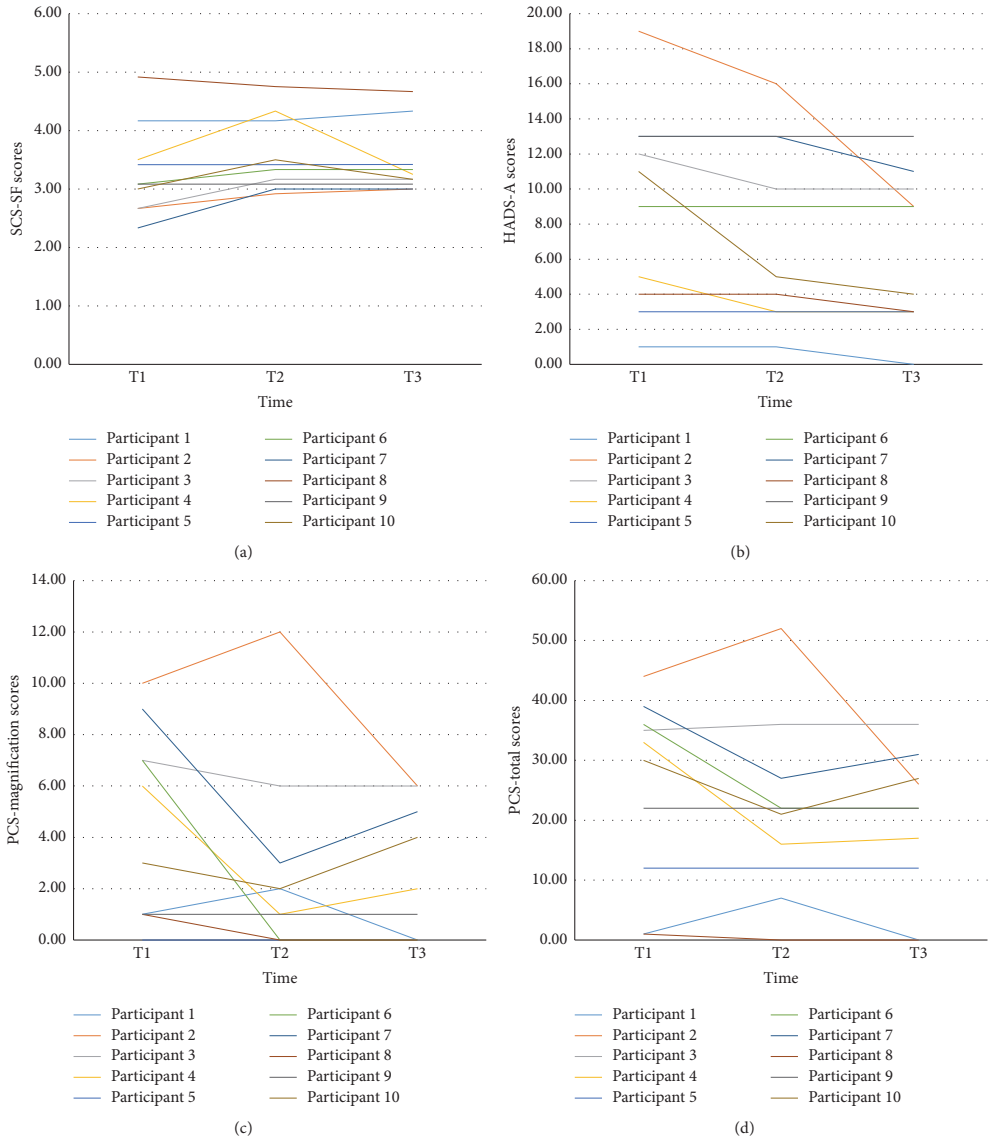

Figure 3: (a) Individual participant Self-Compassion Scale-SF (SCS-SF) scores by time. (b) Individual participant Hospital Anxiety and Depression Scale-Anxiety (HADS-A) scores by time. (c) Individual participant Pain Catastrophizing Scale (PCS)-magnification subscale scores by time. (d) Individual participant Pain Catastrophizing Scale (PCS)-total scores by time.

In terms of clinically meaningful cut-off points, 6 participants had scores above 8 on the HADS-A subscale at T1 and 4 participants had scores at or above 8 on the HADS-D subscale at T1. Out of the six true completers at the end of the study, there were 2 participants with scores above 8 on the HADS-A subscale and 1 participant with a score above 8 for the HADS-D subscale. Using the ITT scores for all participants, there were 5 participants with scores above 8 on the HADS-A subscale and 2 participants with a score above 8 for the HADS-D subscale. Visual inspection of the ITT

data revealed that each participant's score for HADS-A and HADS-D remained the same or decreased with the exception of 1 participant, whose score increased 2 points from T1 to T3 on HADS-D.

3.4.2. Mediation Analysis. Nonparametric bootstrapping analysis showed that the total effect of HADS-A scores at baseline on HADS-A scores at the end of the intervention was significantly reduced when SCS-SF scores at midintervention (the mediator) were added to the model (mean = 0.35, SEM = 0.33; $CI_{.95}$ = 0.05, 1.41). As such, the true indirect effect is estimated to lie between .05 and 1.41 with 95% confidence; as zero is not within the CI interval, it can be concluded that the indirect effect is significantly different than zero, $p < .05$, and that mid-treatment SCS-SF scores mediated the relationship between baseline and end-of-treatment HADS-A scores.

4. Discussion

This pilot study is the first reported trial to evaluate the effects of a yoga intervention on pain and related variables, psychological constructs, spirituality, and mindfulness in a sample of inpatients receiving complex continuing care/rehabilitation for multimorbidities. The results demonstrate post-intervention improvements in anxiety symptoms, the magnification aspect of pain catastrophizing, and self-compassion. As well, self-compassion was found to mediate improvements in anxiety from pre- to postintervention. These results suggest that a Hatha Yoga program specifically tailored to the needs of a hospitalized population experiencing multimorbidities may provide some psychological benefits.

The finding that anxiety scores were significantly lower after the eight-week program is consistent with RCTs that demonstrated improvements in anxiety and health outcomes in individuals with chronic diseases (diabetes or chronic low back pain) who participated in a yoga intervention when compared to walking or exercise/counselling control groups [92, 93]. A recent cross-sectional assessment of a large sample of individuals with a range of chronic illnesses found that self-reported duration of practice (practice session length and number of months practicing) predicted anxiety and the authors concluded that increased doses of yoga practice may help individuals respond to illness with lower levels of anxiety [94]. As well, systematic reviews document improvements in anxiety for several health populations that have participated in a yoga intervention, such as cancer, stroke, and irritable bowel syndrome [19, 31, 95]. In addition, low-income or noninsured individuals who participated in an integrated program involving mindfulness, self-compassion, and yoga, according to a single-group, repeated measures design, were found to have lower levels of anxiety and depression after intervention [96]. It is apparent that yoga provides psychological symptom improvement in both health populations and those who are impacted by low health care resources. This combination of experiences (health concerns, anxiety symptoms, financial strain, and a lack of resources) parallels the presentation of individuals with CCDD and indicates that yoga may reduce anxiety in the context of multiple health-related impacts.

Although pain catastrophizing has been less well studied in yoga trials, two studies (one pilot, one RCT) found that levels of pain catastrophizing were reduced from pre- to post-yoga interventions in samples of women with fibromyalgia [97, 98]. The present results are consistent with these studies in that we found the magnification aspect of pain catastrophizing (e.g., "I wonder whether something serious might happen") decreased from pre- to post-intervention. Pain catastrophizing is a strong predictor of pain severity, pain-related interference, disability, depression, and altered social support networks [99] and is associated with physical function deterioration in individuals with joint pain and comorbidity [100], highlighting it as a useful target for interventions that intend to increase functional ability in individuals with multimorbidity or CCDD. Other pain-related psychosocial factors, such as pain disability and pain acceptance, have been shown to improve with yoga practice [101]. Taken together, these findings provide some evidence that yoga may help to reduce the threat value attributed to pain stimuli or alter pain-related experiences in individuals with medical conditions in which pain is a predominant feature. As well, the potentially debilitating impact of pain-related disability or chronic health stress on financial and social independence for individuals with CCDD may amplify magnification cognitions, pointing to the utility of targeting this construct in yoga interventions.

The benefits of yoga extend beyond decreasing negative cognitive-affective experiences and can also serve to generate or augment a nurturing, positive, and discriminative approach to engaging with inner experiences. Self-compassion is a Buddhist concept that is increasingly being considered as an important mental health construct in Western Psychology and entails three main components: self-kindness, common humanity, and mindfulness [102]. The present findings that self-compassion increased significantly from pre- to post-intervention parallel the results from a yoga research trial in individuals living with an implantable cardioverter defibrillator [103]. The results of that study showed that participants who were randomized to a once weekly, eight-week yoga intervention reported increased self-compassion at the end of the trial compared to a usual care group [103]. For individuals with severe health impacts who typically use avoidance or distancing as coping strategies, a yoga practice may enable them to contact suffering and pain without judgmental or comparative thoughts [102]. Yoga philosophy didactics, which explain that inadequacies, failings, and suffering are considered part of the human condition (shared humanity), may normalize challenging experiences and enable individuals with CCDD to extend forgiveness towards their own short-comings and pain, rather than orienting from the stigma and marginalization that can accompany disability.

4.1. Mechanisms of Action. The finding that self-compassion mediated decreases in anxiety provides some support for self-compassion as a protective agent in distressing psychological experience and in helping to understand how yoga may be

exerting its mechanism of action. This construct has been identified in the yoga literature as one of seven possible mediators of yoga and stress; other mediators include psychological (positive self-affect and mindfulness) and biological (activity in the posterior hypothalamus and inflammatory and endocrine responses: C-reactive protein, Interleukin-6, and cortisol) pathways for therapeutic effects [104]. This is the first study to date that demonstrated the mediating role of self-compassion on psychological changes in a population experiencing medical concerns who participate in a yoga program. There is one previous trial that has demonstrated self-compassion and mindfulness as mediators of quality of life and stress in healthy young adults who participated in a four-month residential yoga intensive [105]. By contrast, self-compassion and mindful attention were not found to mediate changes in emotional stability in high school students who participated in a 16-week yoga program, when compared to students who participated in physical education as usual [106].

This construct may be more amenable to facilitating secondary mental health benefits in individuals experiencing illness-related duress and may impact how individuals cope with chronic and debilitating illnesses. It has been shown to change emotional responses, such as shame, and increase positive coping behaviours in individuals living with HIV and it predicts positive attitudes in the elderly, potentially serving as a buffer against the inevitable challenges associated with age decline [107, 108]. In addition, it is positively associated with both intentions to engage with and practice of health-promoting behaviours (e.g., eating habits, stress management, exercise, and sleep) with indirect effects through adaptive emotions (e.g., health self-efficacy, and positive affect), in community samples of Canadian adults [109, 110]. As the risk of multimorbidity increases with age, augmenting adaptive emotional responses to illness and health-promoting behaviours may assist in the prevention of further health decline and the promotion of well-being.

Although mindfulness was not a mediator of positive psychological change in the present study, previous yoga trials have reported that mid-intervention levels of mindfulness mediated changes in pain catastrophizing from pre- to postyoga intervention in women with fibromyalgia [97]. It may be that these constructs work by exerting different mechanisms during a yoga practice or that one may be more potent as a mediator for different populations or types of mindfulness or yoga interventions. Self-compassion has been demonstrated to be a more robust predictor of symptom severity (e.g., anxious and depressive symptoms) and quality of life than mindfulness in a large community sample of individuals seeking self-help for anxious distress and predicts emotional well-being more consistently than mindfulness in a sample of youth participating in a 5-day meditation retreat [111, 112]. Further examination between psychological well-being, mindfulness, self-compassion, and disability for individuals with CCDD in the context of a yoga intervention is warranted.

4.2. Attending to the Signals of the Body: New Pathways. The role of interoception, which is a complex and multimodal bodily system involving a sense of body parts in space (proprioception) and the act of attending, appraising, and responding to afferent body signals [113], has been considered as one of yoga's underlying mechanisms of action through the process of interoceptive exposure and reconditioning [97]. It is proposed that mind-body interventions, such as yoga, may interrupt habitual ways of perceiving and interpreting body sensations within the context of higher-order cognitive processes, such as goals and intentions, by connecting an individual with the present moment and with their agency for personal change [113]. In addition, it has been proposed that higher level brain networks that are activated by yoga practice may serve to inhibit negative appraisals, rumination, and emotional reactivity while lower level neural networks may downregulate physiological responses to stress, such as inflammatory markers and vasopulminary restriction, through the activation of the parasympathetic nervous system [5]. This is relevant in interpreting the results that pain catastrophizing decreased from pre- to post-interventions, as this construct involves exaggerated or negative cognitive-emotional appraisal of painful stimuli as threatening, is accompanied by perceived helplessness (lack of power), and is associated with aberrant central nervous system processes, such as cytokine or hypothalamic-pituitary-adrenal responses to pain, and activation of neural regions involved in processing affective components of pain [99]. It is clear that pain catastrophizing is a construct involving both emotional and biological processes and it may be that yoga helps individuals to reinterpret physical body signals for what they are, rather than as dangerous threats, through two elements of practice, practicing witness consciousness and then actively creating positive change in the body, which is then reinforced with practice through operant conditioning.

Self-compassion mirrors these two elements of traditional yoga practice, in that it involves a truthful recognition of one's inner state and selecting responses or behaviours that will alleviate suffering. It may be that, through yoga, individuals discover safety in opening to distressing experiences, circumventing, or offering a protective buffer against engrained ruminative or punitive "self-talk," and thereby create new ways of relating to self and prioritizing actions that are consistent with well-being and values. Higher levels of self-compassion have been associated with lower levels of catastrophizing, avoidance, and rumination in chronic pain patients who were presented with vignettes involving a violation of social contract and have been found to predict affect, pain disability, and pain catastrophizing in obese patients with chronic pain [114, 115]. The relationships between self-compassion, anxiety, and disability have been explored in individuals with Generalized Anxiety Disorder; these individuals display lower levels of self-compassion and mindfulness than healthy stressed controls and mindfulness was a better predictor of disability than actual anxiety symptoms, drawing potential protective effects of mindfulness on disability in individuals with chronic worry and physiological symptoms [116]. The relationship between self-compassion and anxiety should be further elucidated and it may be useful

to examine the relationships between the subscales of the SCS to better understand which components of self-compassion are most helpful in mediating changes in anxiety in clinical populations.

4.3. Limitations. There are limitations to the present study. The primary weakness is the absence of a control group, which is a shortcoming that is widespread in the yoga research literature, and makes it impossible to attribute the improvements observed to the yoga practice itself. As well, the small sample size limits power and introduces the possibility of type II error. Logistical limitations included participant difficulty in using the MP3 players and, as a result, reducing homework engagement and completion, which may have reduced overall efficacy of the eight-week yoga intervention. The difficulties that these patients experienced when using the technology are consistent with a previous report indicating that this population has challenges in paying attention and in using assistive technology [117]. Although the research team carefully selected devices with few buttons and minimal steps required to turn on and navigate the devices and also provided large print diagram instructions to accompany the devices, the population still experienced difficulty, which illustrates that they may be better serviced by yoga interventions that do not involve assistive technology for homework components.

4.4. Future Research. The researchers hope that these findings will be considered in the design and implementation of future research projects for individuals who are experiencing CCDD and associated pain, limited mobility, loss of functional ability, severe health impacts, and psychological sequelae. Future research trials should use a randomized, controlled trial study design with appropriate control conditions (e.g., wait-list, exercise, walking, or education) and a longitudinal design with follow-up intervals to determine lasting effects of a yoga practice [118]. Targeting self-compassion in the content and philosophy portions of the yoga interventions may enable researchers to further explore its mediating role of this construct on other psychological or physical experiences prevalent in this population. Trials that seek to further illuminate processes that underlie therapeutic gains may wish to use measures of self-regulation, self-compassion, stress, and positive affect alongside neuroendocrine-inflammatory markers of physiological status [104]. Evaluation of how these variables interact with pain-related constructs associated with the fear-avoidance model of chronic pain (e.g., chronic pain acceptance, pain-related disability, fear of pain, pain anxiety, and pain self-efficacy) may be warranted to better understand the converging impacts that result in distress and disability and with the end purpose to improve health and well-being.

5. Conclusions

The results of the present pilot project suggest that an eight-week specialized yoga program may help to reduce anxiety and the magnification component of pain catastrophizing and to increase self-compassion in patients with multimorbidity. This study provides preliminary evidence for yoga as an auxiliary care service that may be amenable to institutions that are in the process of evolving from single-disease treatment frameworks and that are seeking to assimilate programs and services that can address multiple, intersecting health concerns for various ages. The use of a randomized, controlled trial with a larger sample size and a more intensive yoga intervention design (e.g., two or more classes a week for 10–12 weeks) is recommended to further explore the relationships among pain, psychological experience, and mindfulness or spiritual constructs in individuals who are severely impacted by disease and disability.

Competing Interests

The authors declare that they have no competing interests.

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Section 3: Qualitative Data

In this Section, I present the results of the qualitative interviews conducted with the 10 participants in Study 1. These data were not published in the above article (Curtis et al., 2016) due to space limitations. They are included here to provide a better understanding of the participant's experience in the yoga program and to provide depth to the results of the quantitative data. I first provide information on the procedure, then provide information on the form of analysis used, and finally, provide the results, according to the questions asked in the semi-structured interviews.

Procedure.

Participants were queried on their expectations for the yoga program prior to participation and on their experiences of the yoga program post-participation (Appendix A; Qualitative Questions). A brief form on expectations was administered with the quantitative questions. The participants hand wrote their expectations for participation on the form, which took approximately 3-5 minutes. After the yoga program, interviews entailing open-ended questions were conducted to capture any meaningful changes that occurred and that might not be obtained by the standardized questionnaires. Open ended questions (Appendix A; Qualitative Questions) were asked about experiences with the yoga program; physical, emotional or social gains or changes attributable to the yoga program, perceptions of ones' body; changes in daily life since participation in the yoga program; as well as perceived barriers or any negative effects (Anderzen-Carlsson, Persson Lundholm, Kohn, & Westerdahl, 2014; Cramer, Lauche, Haller, et al., 2013; Garrett et al., 2011). Participants were interviewed by a member of the research team (Kathryn Curtis, Claire Wicks, Mahsa Nasseri) directly after the final class. The interviews

occurred in various locations at BH: in the auditorium where the yoga classes occurred, in participant rooms, and in private areas near the auditorium. The duration of each interview was approximately 15-20 minutes. Participant's responses were hand transcribed verbatim during the interview by the research team members.

Results.

Expectations.

Participants (N = 10) were asked about their expectations for the yoga program (Appendix A; Qualitative Questions) and they reported expecting changes according to five themes: (a) *Physical Function/Improvements* (n = 7; e.g., walking, better range of motion, decrease/manage pain, better posture, being active, strengthen body, better sleep, (b) *Mental Health* (n = 5), with sub-themes of *Relaxation/Calm* (n = 3), *Attitudinal Shift/New Ways of Being* (n = 4; e.g., being mindful, positive attitude in life/more fun and joy despite pain), *Cognitive Improvements* (n = 1), and *Spirituality* (n = 4; e.g., uplift the spirit, have peace, in touch with inner self), (c) *Learning About Yoga* (n = 4; e.g., learn methods of yoga, better breathing techniques), (d) *Social Connectedness* (n = 2), and (e) *No Expected Changes* (n = 2).

Experiences.

Participants (n = 6) were asked ten questions after having participated in the yoga program (see Appendix A; Qualitative Questions). All of the primary themes are presented in Table 6. Responses to the first two questions ("What were your experiences of the yoga program?" and "Did you notice any benefits from the yoga program and if so, what were they?") were very similar and so these two questions were collapsed. Participant responses were grouped

into five themes: (a*) Physical Function,* (b) *Mental Health*, (c) *Yoga as an Accessible Practice*, (d) *Group Component*, and (e) *Overall Helpfulness*. The theme of *Physical Function* (n = 5), included improvements in strength, sleep, health symptom, flexibility, and pain. The theme of *Mental Health* was comprised of three sub-themes: (a) *Transformation/Awakening/Empowerment* (n = 4; e.g., stronger ability to confront and face problems, acquisition of new tools, non-judgement of body sensations, listening and acting without hesitation, getting questions flowing, a sense of knowing where I want to be/place of comfort, and feeling free); (b) *Relaxation/Breathing* (n = 6; e.g., sense of pleasure/delight/calm, breathing, controlling stress/relaxation, sense of letting go, relaxation, and contentment); and (c) *Spirituality/peace* (n = 4; e.g., self-realization, peace and harmony within self, had prayed for this strength/triumph, and a belief that prayer and meditation go hand in hand).

The theme *Yoga is an Accessible Practice* (n = 4) included a desire to keep practicing, that it was educational, putting tools into practice, and safety and simplicity in exercises. The theme of *Group Component* (n = 3) consisted of looking forward to class/needing to go to class, a sense of comradery, enjoying/being comfortable practicing with others and a desire to attend each class. Finally, the theme of yoga as a *Generally Helpful* (n = 3) practice included that it was helpful and enjoyable. Some of these themes are illustrated in a quote from Participant 9: "It teaches you how to breathe. It teaches you how to listen…And it made my body feel free and I felt free and … let (my) body go and (I) felt so free and it's like a gentle breeze on (my) face." As well, Participant 2 stated that the practice provided:

> Self-realization and a sense of peace and harmony within myself. I have a stronger ability to face and confront problems. It was much harder before. My experiences with the illness have made it so that I've gone from a sense of shock

> and disability and now it's from a sense of personal power….Starting to get the questions flowing, I didn't think I had any left but I found a spark in myself. I've been through hell.

In response to Question 3 ("Did you notice any negative effects of the yoga program and if so, what were they?"), participants (n = 3) responses were grouped according to four themes. They described three challenges: (a) *Challenges with Technology* (n = 1), (b) *Challenges with Increased Awareness of Internal Experience* (n = 1) and (c) *Initial Pain* (n = 1). Half of the participants who completed the program did not report any negative effects, (d) *None* (n = 3). Responses to questions 4-7 and 9 were similar so these questions were collapsed. These questions were: "Did your understanding or perception of your health condition(s) change over the course of the yoga program, and if so, how?"; "Since you participated in the yoga program, did your perceptions of your body change, and if so, how?"; "Did you experience any shifts in how you think about, understand or experience your sense of self throughout the yoga program, and if so, what were they?"; "Since you participated in the yoga program, have there been any changes in your perspective about your future? If so, how?"; "Have there been any shifts in how you understand or think about your purpose in life?"

Table 6.

Qualitative Data Main Themes from Post-Yoga Program Interviews (n = 6)

Question	Main Themes
1./2. Experiences and Benefits	(a) Physical Function (b) Mental Health (c) Yoga as an Accessible Practice (d) Group Component (e) Overall Helpfulness

3. Negative Effects	(a) Challenges with technology (b) Challenges with increased awareness of internal experience (c) Initial pain (d) None
Themes across questions: 4./5./6./7./9. Changes in Perspective of Health, Body, Sense of Self, Future, Purpose in Life	(a) Different Perspective (b) Yoga to Enhance Rehabilitation (c) Deeper Connection to Body/Listening to Body/Respect for Body (d) Greater Connection to Self (e) Present-mindedness (f) Taking Practice to Life (g) Sense of Giving or Connection to Others (h) No Change or Mild Changes
8. Change in Daily Life	(a) Activity/Life Engagement (b) Independence
10. Recommendations	(a) Room Specifics (b) Program Specifics (c) No Recommended Changes

Similar to questions 1 and 2, participants reported benefits in experiences with the physical body (e.g., more strength, better sleep, weight loss), the mind (e.g., can relax more, more serenity), and the breath (e.g., better breath). New themes that emerged from the responses to these questions included: (a) *Different Perspective* (n = 3; e.g., more acceptance, calm perception, new understanding that there's a way to overcome/conquer problem, no end to what I can do/lack of limits); (b) *Yoga to Enhance Rehabilitation* (n = 3; e.g., enhancement of current plan, yoga should be used for debilitating conditions, more confident about painful and difficult rehabilitation); (c) *Deeper Connection to Body/Listening to Body/Respect for Body* (n = 3; e.g., body as a journey/experience, challenging experiences with invasive surgery as an opportunity, more realized in my body, sense of body as a temple, tune into/listen to body); (d) *Greater*

Connection to Self (n = 2; e.g., enhanced sense of self, in tune with psyche, more spiritual); (e) *Present-mindedness* (n = 3; e.g., ability to live in the moment, more focused and controlled, has an internal place to go for comfort); (f) *Taking Practice to Life* (n = 3; e.g., more energized/easier to do more/no limits, wanting to get better/caring about the future/hope/taking life seriously, will take relaxation practices to life); (g) *Sense of Giving or Connection to Others* (n = 4; e.g., generosity of spirit to others, wanting to be there for family, self in context with others, family as a reason to live); and (h) *No Change or Mild Changes* (n = 5; e.g., to perceptions of health, body or self). Some of these themes highlight a new hope, which a quote from Participant 9 illustrates;

> My future - I want to get better, I want to leave here. Before I didn't care if I was here and now I want to leave - I have 2 grandchildren. I wasn't taking life seriously but my grandchildren will grow up and I want to be with them and get better. I don't want to stay here for the rest of my life…Yes, I have a purpose right now - to be with my family. That's a big purpose, to get well and be with my family. Before the yoga program I wasn't as interested in the world or anything else. I have a young family. I want to be with them.

Participant 2 described how the yoga program impacted her experiences during a surgery she had at BH while a participant in the yoga program:

> I had a hockey puck [sized object] implanted in my abdomen, it's (sic) visible and you can feel it. It could have been a horrendous…I think the entire surgery experience (recovery, infection) were handled much more easily and (I) found it manageable. It was a journey, an experience. I almost enjoyed having the surgery and without the peace and confidence the program provided, it wouldn't have happened like that.

In response to Question 8 ("Since you participated in the yoga program, has your daily life changed? If so, how?"), two new themes emerged: (a) *Activity/Life Engagement* (n = 4; e.g., scheduling/fulfilling commitments, maintaining skills/interests, days go better, more focused day-to-day, take part in more activities, don't want to miss any activities/going to the gym/walking more); and (b) *Independence* (n=3; e.g., better coping/problem solving, more awareness of how to do things, activities, can now wash independently, can come down from bed without sling).

Participants were also asked if their expectations had been fulfilled, and if so, how, and if not, what would have been necessary for their expectations to be fulfilled. All participants reported many but not all expectations were met (n = 6); some participants would have liked to have more movement or stretching for the legs (n = 3). Some reported that they were initially skeptical but liked it more than they thought they would (n = 2). In terms of recommendations, three themes emerged: (a) *Room Specifics* (n = 2; e.g., different lighting, warmer, preference to have all classes in the same room), (b) *Program Specifics* (n = 4; e.g., better training for mp3 player, louder voice/instructions, full body, longer program, more participants, more stretching of the legs, more focus on movement/body function), and (c) *No Recommended Changes* (n = 2).

In summary, five main themes emerged about their experience in the program: *Physical Function, Mental Health, Yoga as an Accessible Practice, Group Component*, and *Overall Helpfulness*. The theme of *Physical Function* included improvements in strength, sleep, health symptom, flexibility, and pain. The theme of *Mental Health* was comprised of three sub-themes: *Transformation/Awakening/Empowerment, Relaxation/Breathing,* and *Spirituality/Peace*. The theme *Yoga is an Accessible Practice* highlighted that the participants found the program educational and found the practices safe and simple. They stated that they looked forward to

attending class and were comfortable practicing with others (*Group Component*). Participants reported *Challenges with Technology, Challenges with Increased Awareness of Internal Experience,* and with *Initial Pain*. Participants reported obtaining a *Different Perspective* (e.g., more acceptance, calm perception, no end to what I can do/lack of limits), a *Deeper Connection to Body/Listening to Body/Respect for Body* (e.g., body as a journey/experience, more realized in my body, sense of body as a temple) and a *Greater Connection to Self* (e.g., enhanced sense of self, in tune with psyche). They reported increased mindfulness (*Present-mindedness*; e.g., ability to live in the moment, has an internal place to go for comfort) and that they were *Taking Practice to Life* (e.g., more energized, easier to do more, wanting to get better, caring about the future). They felt more connected to others (*Sense of Giving or Connection to Others*; e.g., generosity of spirit to others, wanting to be there for family), greater *Activity/Life Engagement* (e.g., take part in more activities, going to the gym/walking more) and more *Independence* (e.g., can now wash independently, can come down from bed without a sling). They believed that yoga should be incorporated as part of rehabilitation strategies (*Yoga to Enhance Rehabilitation*; e.g., enhancement of current plan, yoga should be used for debilitating conditions) and would like more attention to the lower body parts. Their expectations for participation were mostly fulfilled.

Summary of Study 1 and rationale for Study 2.

Taken together, the results from the quantitative and qualitative data suggest that yoga may provide psychological and physical benefit to individuals with CCDD, for whom pain and mobility are primary concerns. The results from the quantitative data suggest that a yoga program may result in decreases in anxiety, reductions in the magnification aspect of pain catastrophizing, and increases in self-compassion. The results from the qualitative data

highlighted that the participants noticed improvements in physical function (e.g., pain, strength), independence (e.g., in tasks of daily living), and psychological experiences (e.g., relaxation, empowerment, peace). They reported a shift in orientation involving a new perspective, an ability to be mindful and bring the practice to life, and a greater connection to themselves, their bodies, and others. The program was safe and enjoyable and participants recommended it be integrated into rehabilitation settings. These positive effects must be viewed with caution because of the nature of the design used. Since Study 1 was a single group cohort study without any control condition the observed changes can not be attributed to the effects of the yoga intervention and should be interpreted as preliminary evidence. Nonetheless, the results of Study 1 point to the utility of yoga for individuals with severe mobility impairments and chronic pain and suggest that further evaluation is warranted for other populations with mobility impairments, such as individuals with SCI. Similarities between these two populations include variability in degree of mobility impairment, the necessity to use a wheelchair, and the presence of multiple and intersecting health conditions and events. Chapter 4, which follows, consists of two sections: the first section presents the objective and hypotheses; and the second section presents the published manuscript.

Chapter 4: Study 2, Pilot Study Evaluating Yoga for Spinal Cord Injury

Section 1: Objective and Hypotheses

Objective.

The main objective of this pilot study was to evaluate a specialized 8-week yoga intervention for individuals with SCI who were connected with a rehabilitation hospital. As well, a secondary objective was to determine if the participants were satisfied with the yoga program. Therefore, the objectives were two-fold: 1) to evaluate changes in levels of pain and related factors, fatigue, psychological factors (positive and negative affect, self-efficacy) and mindfulness, and 2) to determine if participants were satisfied with the yoga program.

Hypotheses.

The present study had three hypotheses:

1. Participants would demonstrate improvements in pain, fatigue, psychological, and mindfulness constructs from pre- to post-intervention.
    a) It was predicted that scores on measures evaluating pain, pain interference, and pain catastrophizing would be significantly lower at post-intervention.
    b) It was predicted that scores on measures evaluating fatigue and negative affect would be significantly lower at post-intervention.
    c) It was predicted that scores on measures evaluating positive affect, self-efficacy, and mindfulness would be significantly higher at post-intervention.
2. Analysis of qualitative interviews with the sample would reveal the positive impact of yoga on the lived experience of individuals with SCI.

3. Participants of the yoga program would be satisfied with the yoga program. Specifically, it was predicted that scores on measures evaluating yoga satisfaction would indicate moderate levels of satisfaction.

Section 2: Published Article

The following study was published in the Therapeutic Recreation Journal, 2015, XLIX, No.2, 97-117. Permission to reproduce the article in the dissertation was obtained from the publisher (See Appendix B).

Therapeutic Recreation Journal Vol. XLIX, No. 2 • pp. 97–117 • 2015

Research Paper

Evaluation of a Modified Yoga Program for Persons with Spinal Cord Injury

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Abstract: Yoga is a promising mind-body intervention for improving health and well-being in a number of clinical populations. At this time, there is no evidence on the benefits of yoga for persons with spinal cord injury (SCI). Twelve participants with SCI were recruited into a mixed-methods program evaluation of an eight-week modified yoga program. At baseline and exit, participants were evaluated on pain, fatigue, psychological factors, and mindfulness with self-report questionnaires and semi-structured interviews. Five participants completed the baseline and exit assessments. Significant changes were not found on any of the outcome scores. Qualitative analysis revealed main themes regarding expectations, benefits along emotional, mental, and physical domains, program satisfaction and recommendations. Participants reported highly enjoying the yoga intervention and the qualitative data indicated a number of therapeutic benefits (i.e., decreased stress, pain relief). Yoga appears to be a promising therapeutic recreation intervention post-SCI and a larger clinical trial is recommended to conclusively investigate both its objectively and subjectively measured benefits.

Keywords: *spinal cord injuries, yoga, therapeutic recreation, program evaluation, pain, fatigue, mindfulness, self-efficacy, affect*

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Introduction

Sustaining a spinal cord injury (SCI) creates major challenges for maintaining physical and mental health and for community participation (Carpenter, Forwell, Jongbloed, & Backman, 2007). The injury typically results in motor, sensory, and autonomic impairments leading to significant changes in physical functioning (Kirshblum, 2005). These changes include altered mobility, bladder and bowel dysfunction, changes in body temperature and blood pressure regulation, and altered or absent cutaneous sensation below the level of the injury. As a result, individuals with SCI are highly susceptible to develop secondary health conditions, such as pressure ulcers, spasticity, and chronic pain (Hitzig, Campbell, McGillivray, Boschen, & Craven, 2010). The occurrence of both primary (i.e., paralysis) and secondary impairments (i.e., pain) impedes an individual's ability to fully participate in his or her community or in leisure activities that may contribute to a meaningful quality of life (QoL).

In addition, individuals with SCI experience higher levels of pain than normative samples, which can impact social and psychological functioning, as well as activities of daily living (Jensen, Hoffman, & Cardenas, 2005). Pain related cognitions such as pain catastrophizing are recognized as negatively impacting experiences with pain and functional ability in individuals with SCI and other disability groups (Jensen, Moore, Bockow, Ehde, & Engel, 2011). With respect to mood and psychological well-being, persons with SCI have lower positive affect and greater levels of depression when compared to age matched controls (Salter, Smith, & Ethans, 2013). Physical and mental health experiences intersect in individuals with SCI; those who experience higher levels of fatigue also experience higher levels of depression, anxiety, and lower levels of self-efficacy and QoL (Craig, Tran, Wijesuriya, & Middleton, 2012; Wijesuriya, Tran, Middleton, & Craig, 2012).

Engaging in leisure activities after SCI is a considerable challenge (Kennedy & Rogers, 2000; Scelza, Kalpakjian, Zemper, & Tate, 2005). This is reflected in high rates of boredom and sedentary lifestyles reported by this population (Caldwell & Weissinger, 1994; Kleiber, Brock, Lee, Datillo, & Caldwell, 1995; Lee & Mittelstaedt, 2004; Lee, Mittelstaedt, & Askins, 1999). Barriers to leisure activities such as physical activity post-SCI can be intrapersonal (physical and psychological), systemic (accessibility, financial cost) or informational (lack of knowledge, lack of awareness) (Martin Ginis, Jorgensen, & Stapleton, 2012). With regard to psychological barriers, emotional and mental health issues that might arise early post-injury, such as altered body image and depression (Loy, Dattilo, & Kleiber, 2003), can impede engagement in physical activities after initial SCI rehabilitation (Vissers et al., 2008). Further, there is evidence to show that poor adjustment early after SCI leads to long-term difficulties, whereas those who cope well following their injury tend to continue to cope well over time (Pollard & Kennedy, 2007). On the other hand, general self-efficacy has been identified as a potentially useful target to increase participation after SCI (Peter et al., 2014). There is a need for therapeutic interventions that are easily adaptable for people wiht a SCI and can be introduced early post-injury in order to help maximize physical and mental health.

Yoga is a promising mind-body intervention for improving health and well-being in a number of able-bodied and clinical populations (Wren, Wright, Carson, & Keefe, 2011). The word yoga comes from the Sanskrit term "yug" which is

commonly translated as a state of union; however, it is also defined as cultivating deep concentrative awareness (Bechsgaard, 2013). Yoga is a comprehensive system that uses physical postures (*asana*), breathing exercises (*pranayama*), concentration and meditation (*dharana* and *dhyana*) and contemplative practice. Through the repeated practice of these yogic techniques, the student of yoga may experience improvements along physical, mental and emotional dimensions of self. A multitude of schools of yoga can be found in contemporary practice, but a common thread is a focus on the development of strength and mobility through practice of the asanas.

In various disability groups or compromised populations with mobility impairments and/or chronic pain (i.e., osteoarthritis, rheumatoid arthritis, stroke, multiple sclerosis, fibromyalgia, chronic low back pain, AIDS, chronic pancreatitis), yoga interventions have been shown to reduce pain, stress and fatigue, increase functional strength, and improve mood, cognition, balance, and QoL (Boehm, Ostermann, Milazzo, & Bussing, 2012; Bonadies, 2004; Bussing, Ostermann, Ludtke, & Michalsen, 2012; DeMayo, Singh, Duryea, & Riley, 2004; Harper, 2013; Lazaridou, Philbrook, & Tzika, 2013; Oken et al., 2004; Salgado et al., 2013; Sareen, Kumari, Gajebasia, & Gajebasia, 2007; Ward, Stebbings, Cherkin, & Baxter, 2013; Wren et al., 2011). Yoga also positively impacts psychological experiences, such as pain catastrophizing, mood, anxiety, self-efficacy, positive and negative affect, social function, and mindfulness in clinical and nonclinical populations (Balasubramaniam, Telles, & Doraiswamy, 2013; Bonura & Tenenbaum, 2013; Bussing, Michalsen, Khalsa, Telles, & Sherman, 2012; Curtis, Osadchuk, & Katz, 2011; Vadiraja et al., 2009). Furthermore, there is qualitative evidence for the positive impact of yoga on belongingness, sense of connectedness, self-transformation, sense of purpose, and acceptance of changes to one's body, which may be relevant to individuals with SCI (Garrett, Immink, & Hillier, 2011). Yoga may serve to broaden an individual's repertoire of available resources in terms of open mindedness, creativity, curiosity, and acceptance of one's body, and therefore reduce constraints to participation and physical activity engagement and increase QoL and leisure (Van Puymbroeck, Schmid, Shinew, & Hsieh, 2011; Van Puymbroeck, Smith, & Schmid, 2011). Pain, health, and QoL in individuals with SCI are related to caregiver satisfaction with life and mental health and it is recommended that SCI rehabilitation interventions target caregiver well-being (Coleman et al., 2013). Yoga has been shown to increase coping ability and to improve endurance, flexibility, and strength in informal caregivers; it is possible that yoga could be used as a recreational activity to simultaneously address the well-being of both individuals with SCI and their caregivers (Van Puymbroeck, Payne, & Hsieh, 2007). Although research trials have yet to evaluate the impact of yoga on individuals with SCI, it has been recommended that Iyengar yoga be integrated into SCI rehabilitation therapies to increase physical functioning and to cultivate a positive mind-body experience (Zwick, 2006).

An important facet of yoga that may contribute to change processes is mindfulness, which has been recognized for gains in a variety of physical and mental health conditions. Mindfulness is rooted in Buddhist and contemplative philosophies and is characterized by paying total attention in the present moment with a nonjudgmental awareness of, and open-

ness to, inner and outer experiences (Kabat-Zinn, 1994). Elements of mindfulness are inherent in many schools of yoga through the cultivation of an internal witness. The practice of observing one's experience without fully identifying with it is utilized during the practice of physical postures as well as in daily life throughout the yoga tradition. Mindfulness has been proposed as a mechanism of yoga-induced improvements in pain catastrophizing in women with fibromyalgia (Curtis et al., 2011). Other possible mechanisms of yoga's effects include self-efficacy and exercise, both of which have been shown to be mediators of improvements in back pain-related disability in the context of a yoga intervention (Sherman, Wellman, Cook, Cherkin, & Ceballos, 2013).

Independent of yoga, mindfulness has been found to negatively predict pain intensity, pain catastrophizing, pain-related fear, pain hypervigilence, negative affect and functional disability in chronic pain patients (Schutze, Rees, Preece, & Schutze, 2010). Furthermore, meditation is considered almost as effective as tricyclic antidepressants and anticonvulsant agents in the treatment of pain post-SCI (Cardenas & Felix, 2009). In other disability populations, such as mild traumatic brain injury, a standardized but uncontrolled mindfulness-based stress reduction (MBSR) intervention resulted in clinically significant improvements in self-efficacy and QoL from pre- to postintervention (Azulay, Smart, Mott, & Cicerone, 2013). A randomized controlled trial evaluating cancer related fatigue found that individuals randomized to an MBSR program reported significantly lower fatigue and depression from pre- to postintervention than wait-list controls (Johns et al., 2014). Mindfulness is purported to be useful in a wide range of chronic conditions and a meta-analysis reported that MBSR programs consistently result in improvements in QoL, psychological factors (depression, anxiety, coping style), affective elements of disability, and physical health (Grossman, Niemann, Schmidt, & Walach, 2004). Furthermore, MBSR programs may offer protective properties for caregivers in terms of the mental health challenges, such as depression and anxiety, which often emerge over time (Van Puymbroeck & Hsieh, 2010). Given its emphasis on mindfulness concepts, such as present-mindedness and acceptance, yoga may be a well-suited mind-body intervention for individuals with SCI. Yoga programs may be easily modified for varying degrees of impairment and mobility, making it a highly accessible intervention for individuals with SCI.

The purpose of this pilot study was to conduct an evaluation of an eight-week, modified yoga program for individuals with SCI, in terms of both participant experiences and also with respect to program satisfaction. The primary hypothesis of the present study is that participation in an eight-week yoga program would lead to improvements in the following measures from pre- to postintervention: pain, pain catastrophizing, fatigue, psychological factors (self-efficacy, positive and negative affect), and mindfulness. The results of this evaluation may provide insight into the benefits of yoga for individuals with SCI, point to suggestions for implementation of yoga into clinical practice, and guide future research.

Methods

Yoga Program

The Therapeutic Recreation (TR) department at the Toronto Rehabilitation Institute's Brain and Spinal Cord

Rehabilitation Program (Lyndhurst Centre) conducted the eight-week yoga program. The program consisted of one 45- to 60-minute class per week, and was taught by a certified yoga teacher with 500 hours of training. The dosage of one class a week was decided in alignment with the yoga literature and participants were not given homework in order to prevent possibly unsafe practice of yoga in an unsupervised environment (Ward, Stebbings, Sherman, Cherkin, & Baxter, 2014). A TR staff member designed the program length and duration of classes, and the yoga instructor designed the content of the classes with input from the first author (KJBC), herself a certified yoga instructor. As such, the program was designed in accordance with the literature and also with a clinical perspective of participants' unique needs. A TR staff member and the first author assisted the instructor when teaching the classes. The classes were offered at no cost to the participants. Both in- and out-patients with SCI were provided the opportunity to participate in this comprehensive program, which focused on breath awareness, nonjudgmental attention to present experience, mindful movement, and a supportive environment.

This program drew elements from Hatha yoga, Iyengar yoga, and Vinyasa yoga. The word Hatha is composed of the Sanskrit terms "Ha" and "Tha," which refer to the sun, or heating and activating properties, and to the moon, or cooling or calming properties, respectively. By balancing these opposing qualities, physical and mental health are fostered and the development of self-awareness and mind-body unity are cultivated (Raub, 2002). Iyengar yoga emphasizes careful alignment of the muscles and bones in each posture in order to execute each pose with optimum safety and awareness, and to minimize the risk of injury or strain (Ward et al., 2014; Zwick, 2006). Although Iyengar yoga typically uses a variety of props as aids in performing asanas (postures), this program did not have access to props and so only principles of right action and alignment were used. Vinyasa yoga focuses on the synchronization of breath with movement to create a seamless sequence of postures. In this form of yoga, the inhalation and exhalation of the breath are coordinated with stages of awareness or physical movement.

The sessions began with the instructor facilitating a mindful check-in or brief meditation. At this stage, participants were directed to focus and bring awareness to their breathing. Succinct teachings on mindfulness concepts such as letting be and acceptance of physical and mental states in the present moment were provided. These opening exercises lasted approximately 5 to 10 minutes. The majority of the class centered on seated asanas, with a focus on upper body movement and action. The asanas performed in class included urdhva hastasana and related variations, neck rolls, garudasana preparation and garudasana, uttanasana variation, marjaryasana variation, bitilasana variation, thoracic extension variation, and general arm stretch and shoulder openers. The postures were sequenced in a purposeful way to build on awarenesses and actions learned in previous poses. In addition, breath movement coordination (Vinyasa yoga) was used in order to transition between poses and to encourage a sustained inward focus. In order to create an environment of practice that was accessible to all participants regardless of their mobility, instructions focused on awareness, sensations, and stages of movement. For example, participants were encouraged to first bring

awareness to a part of the body, to cultivate awareness of initiating movement, and finally to move that part of the body if possible. If a participant did not have sensation or motor control over a body part, they were encouraged to return to breath awareness. Participants who required hands-on assistance were attended to by a clinical staff member. Participants were encouraged to gently push to the edge of comfort and actively engage their muscles in order to build strength and flexibility, while also practicing safely within personal limits with respect to pain and fatigue. The asana portion of the class was followed by a meditation and breathing exercise and then closed with a mindful check-in.

Participants

Staff at Toronto Rehabilitation Institute's (TRI) Brain and Spinal Cord Rehabilitation Program (Lyndhurst Centre) circulated flyers to in- and out-patients. A member of the care team asked persons who expressed an interest in participating if a member of the research team could discuss the yoga study with them. Inclusion criteria for participation were as follows: participants must be able to understand instructions in English, participants must be 18 years of age or older, participants must be able to do 45 minutes of physical activity at a time, and participants must attend the program willingly. Twelve potential participants provided informed consent to participate in the study. One person withdrew from the yoga program prior to starting the first yoga class. The remaining sample consisted of 10 women and one man, five of whom were in-patients and six from the community (see Table 1). Nine participants reported sociodemographic and injury characteristic data and two participants did not provide this information. Demographic information was reported for all recruited participants who provided this information, regardless of whether they completed the yoga intervention and postintervention measures.

Self-Report Measures

In order to evaluate program satisfaction, the Yoga Satisfaction Scale was administered at the end of each session. As part of routine program evaluation of yoga programs at TRI, the Toronto Mindfulness Scale (TMS) was also administered after every class. In order to test the hypothesis that the yoga program would result in improvements in participant experiences with pain and related constructs, fatigue and psychological factors, the following measures were administered; Brief Pain Inventory-Short Form: BPI-SF, Pain Catastrophizing Scale: PCS, Fatigue Severity Scale: FSS, Positive and Negative Affect Scale: PANAS, General Self-Efficacy Scale: GSES, and the Cognitive and Affective Mindfulness Scale-Revised: CAMS-R.

Yoga Satisfaction Scale (YSS). The YSS is a nonstandardized measure designed by the authors and developed for the present study to capture participants' perceived satisfaction with the yoga program. The scale also contains questions regarding sociodemographic status and injury information (gender, age, months postinjury/onset, cause of SCI/lesion, severity of SCI/lesion [complete, incomplete], and level of injury/lesion [paraplegia, tetraplegia]). The demographic portion of the scale was administered only at the first class, while the three items regarding satisfaction were administered after every class. The three-item survey asked participants to rate 1) their enjoyment of the class, 2) if the class made them feel relaxed, and 3) if they would participate in more classes. They responded using a 10-point scale ranging

Table 1

Demographic and Impairment Characteristics

	All Participants (n = 11) Number	Completers (n = 5) Number
Sex		
Men	1	1
Women	10	4
Etiology		
Traumatic	6	3
Non-traumatic	3	2
Not reported	2	-
Impairment		
Complete[1]	3	2
Incomplete[2]	6	2
Unknown	1	1
Not reported	1	-
Tetraplegia	2	2
Paraplegia	6	1
Unknown	1	1
Not reported	2	-
Status		
In-patient	5	0
Community-dwelling	6	5
Mean Age in yrs *(SD)*[3]	48.4 (15.0)	44.6 (13.9)
Mean Months Post-Injury *(SD)*[3]	157.4 (191.8)	276.4 (178.7)

Note 1 – complete injuries are those with no motor and/or sensory function below the level of lesion.
Note 2 – incomplete injuries are those with some motor and/or sensory function below the level of lesion.
Note 3 – Two participants declined providing data on age or injury duration.

from: 1 (*Strongly Disagree*) to 10 (*Strongly Agree*). The YSS also has open-ended items requesting feedback on what participants enjoyed and what suggestions they had for future classes.

Brief Pain Inventory (BPI)–Short-Form (Cleeland & Ryan, 1994; Daut, Cleeland, & Flanery, 1983). The BPI-SF is a 9-item self-report questionnaire that measures various aspects of pain and pain interference with daily activities using 11-point scales. The BPI has strong internal consistency (Cronbach's α = .85 and .88 for the Intensity and Interference scales) and adequate construct validity. The pain interference subscale has been used in many studies of pain in people with SCI (Jensen et al., 2005; Stroud, Turner, Jensen, & Cardenas, 2006), and has excellent reliability (Cronbach's α > .90), and validity for SCI (Raichle, Osborne, Jensen, & Cardenas, 2006).

Pain Catastrophizing Scale (PCS) (Sullivan, Bishop, & Pivik, 1995). The PCS is a 13-item self-report scale that measures catastrophic thinking in rela-

tion to how individuals experience or anticipate pain. Items are scored on a 5-point scale: 0 (not at all) to 4 (all the time). Scores range from 0-52 and higher scores reflect higher levels of pain catastrophizing. The PCS has high internal consistency (coefficient α = .87). Pain catastrophizing is related to pain, and physical and psychological disability in clinical and nonclinical populations (Crombez, Eccleston, Baeyens, & Eelen, 1998; Sullivan, Tripp, Rodgers, & Stanish, 2000), including in SCI (Giardino, Jensen, Turner, Ehde, & Cardenas, 2003; Turner, Jensen, Warms, & Cardenas, 2002).

Fatigue Severity Scale (FSS) (Krupp, LaRocca, Muir-Nash, & Steinberg, 1989). The FSS is a 9-item self-report questionnaire that evaluates the severity of fatigue and the impact on lifestyle and activities. Responders indicate the degree to which they agree with each item according to a 7-point scale: 1 (*strongly disagree*) to 7 (*strongly agree*). The maximum score is 63, where higher scores reflect higher levels of fatigue. The FSS has been shown to be a valid and reliable (Cronbach α = .89, intraclass correlation coefficient, .84; 95% confidence interval, .74 – .90) measure for SCI (Anton, Miller, & Townson, 2008).

General Self-Efficacy Scale (GSES) (Schwarzer & Jerusalem, 1995). The GSES is a 10-item scale that is designed to assess optimistic self-beliefs regarding one's perceived ability to cope with a variety of daily hassles and stressful life events. Items are scored using a 4-point scale: 1 (*not at all true*) to 4 (*exactly true*). The GSES has a maximum total score of 40 with higher scores reflecting higher perceived self-efficacy. The scale has been widely used and demonstrates high internal consistency (α = .86), unidimensionality and construct validity (Scholz, Gutiérrez Doña, Sud, & Schwarzer, 2002). The GSES has been used in the SCI population, and the construct of self-efficacy has been tied to a number of favorable outcomes post-SCI (Hampton, 2011; Kennedy, Taylor, & Hindson, 2006; Mortenson, Noreau, & Miller, 2010; Nicholson Perry, Nicholas, & Middleton, 2009).

The Positive Affect and Negative Affect Scale (PANAS) (Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item self-report questionnaire that measures positive and negative constructs as both states and traits. Ten descriptors are used for each affect scale: 1) positive affect (PA) and 2) negative affect (NA). Items are scored using a 5-point scale: 1 (*very slightly or not at all*) to 5 (*extremely*). The highest score for each subscale is 50 and higher scores reflect higher levels of affect. The internal consistency coefficient for PA is .89 and for NA is .85, and has good convergent validity with measures of depression (Crawford & Henry, 2004). The PANAS was selected as it was thought to be a sensitive tool for detecting any immediate changes in participants' moods that they may experience due to their participation in the yoga program.

Toronto Mindfulness Scale (TMS) (Lau et al., 2006). The TMS is a 13-item, self-report questionnaire used to assess how an individual experiences and reacts to thoughts, feelings and sensations they experience in daily life. Responders are asked to indicate the degree to which they agree with an item according to a 5-point scale: 0 (*not at all*) to 4 (*very much*). The highest possible total score is 52, with higher scores indicating higher levels of mindfulness. The TMS has two subscales, curiosity (6 items; highest score of 24) which measures present moment awareness with an attitude of curiosity,

and decentering (7 items; high score of 28), which measures the extent to which an individual has the ability to distance or disidentify with thoughts or feelings. Both subscales have moderate inter-item correlations: curiosity, $r = .50$, and decentering, $r = .39$ (Lau et al., 2006). The two-factor structured scale has high internal consistency ($\alpha = .95$), moderate correlations between each item and the total items ($r = .53$) and is predictive of treatment outcome (Lau et al., 2006).

Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) (Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). The CAMS-R is a 12-item scale that measures elements of everyday mindfulness, such as regulation of attention, awareness of present experience and an attitude of acceptance. Items are rated on a 4-point scale: 1 (*rarely/not at all*) to 4 (*almost always*). Ratings on the items are summed and the highest possible score is 48; higher scores reflect greater mindfulness. The total score has acceptable internal consistency (Cronbach $\alpha = .74 - .77$) and good convergent validity with other measures of mindfulness. Scores on this measure are also correlated with measures of distress, emotional regulation and well-being.

Semi-Structured Interviews. After the last class attended (prior discharge from TRI or postintervention), participants were asked to partake in a brief semistructured interview to obtain their perceptions and feedback of the yoga program. Participants were asked the following open-ended questions: 1) "What were your expectations of the program?" 2) "What aspects of the program did you find enjoyable?" 3) "What aspects of the program did you not like or thought could be improved?" 4) "What were some of the changes (e.g. emotional, physical), if any, you noticed about yourself during or after the program?" and 5) "Overall, how satisfied were you with the program?" Prompts and points of clarification were asked to explore answers in-depth and to ensure the interviewer's proper understanding of the responses (Creswell, 2003).

Procedure

This study was approved by the Research Ethics Board of the Toronto Rehabilitation Institute; all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed. After obtaining informed consent, participants were asked to complete the questionnaire package prior to attending the yoga program (prior to class 1) and at the end of the program (after class 8). This included the BPI-SF, FSS, GSES, PCS, PANAS, and CAMS-R. All participants were asked to complete the YSS and TMS at the end of every class. The qualitative interviews occurred in a private room and the duration of the interviews was approximately 10-20 minutes. Interviews were recorded with participant consent and were later transcribed. Staff members helped some participants to fill out the questionnaires.

Analysis

Survey data from the YSS was used to generate descriptive statistics and frequencies regarding demographics. Means (SD) were generated for each of the three questions on the YSS (Enjoyment, Relaxation, Would Come Again) to determine satisfaction with the program. Wilcoxin signed-rank tests were used to evaluate changes in pain, fatigue, psychological factors and mindfulness from pre- to post-intervention. Fisher's exact test was used to compare differences between participants who completed and did not complete the program on gender (male vs. female), etiology (traumatic vs. non-

traumatic), level (tetraplegia vs. paraplegia), and patient status (in-patient vs. out-patient). Mann-Whitney U test was used to compare completers and non-completers on age and all baseline variables.

For qualitative content analysis and interpretation, fundamental qualitative description methodology as described by Creswell (2003) and Sandelowski (2000) was used to provide a comprehensive summary of the information conveyed by the participants during the interviews. This method of analysis seeks to provide descriptive validity, or an accurate description of the participants' responses during the interviews, and interpretive validity, an accurate accounting of the meanings that participants attribute to their responses. This methodological approach has been successfully used in other SCI studies to obtain the perspectives of this population on different issues (Hammel et al., 2008; Norman et al., 2010). The first step in the analysis involved reading (by a research investigator) the transcript of the interview as a whole, in order to obtain a general sense of the information provided by the participant. The second step involved line-by-line re-readings of the transcript and initial clustering of concepts according to units of meaning for each question. Through the process of distillation/condensation, passages were identified and shortened while preserving the core meaning; and through the process of aggregation/abstraction, codes, themes, and categories were created on various levels (Graneheim & Lundman, 2004). Two members of the investigation team independently read and coded each transcript and then resolved any points of disagreement in coding through discussion. Instances of disagreement were few and minor in nature. Codes were sorted into thematic categories based on similarity. As scoring progressed, some codes were merged together to avoid redundancy in the coding framework, and other codes were added as new insights emerged. The transcripts were re-read and re-coded several times each in order to ensure that the coding framework captured the content expressed in the interviews and to determine whether saturation had been achieved (Creswell, 2003).

Results

Of the 11 participants who did the baseline assessment, five completed four sessions or more (see Table 2). The remaining sample consisted of four females and one male, all of whom were living in the community (see Table 1). Fisher's exact test confirmed that participants who were outpatients were more likely ($p < .05$) to complete the program than participants who were in-patients. Table 2 presents the satisfaction ratings for each of the eight classes and scores for the TMS collected after each session. Table 3 presents the scores for all outcome measures. Wilcoxin signed-rank tests did not reveal statistically significant differences between baseline and exit scores on any measure (all $p > .05$).

Qualitative Reports

Through the qualitative analysis of participant interviews (n=6; five participants who completed four-eight classes and one participant completed three classes), and a variety of themes emerged. Although the authors had decided, a priori, to use four sessions as the cut-off for being a "completer," due to the exploratory nature of this study, the authors believe that it is meaningful to include the data from a sixth participant who was available for interview and who only completed three classes.

Table 2

Yoga Class Atteendance, Class Perceptions, and Toronto Mindfulness Scale (TMS) Scores

Class #	# Attendees	# Completed Post-Class Assessment	Enjoyable (M; SD)	Relaxing (M; SD)	Would Come again (M; SD)	TMS Curiosity (M; SD)	TMS Decentering (M; SD)
1	9	7	8.0 (2.3)	8.3 (2.1)	9.0 (1.3)	15.8 (3.2)[a]	15.8 (2.2)[a]
2	8	8	8.3 (1.0)	8.0 (0.9)	8.6 (1.3)	10.8 (3.3)	12.8 (4.2)
3	8	7	7.7 (1.3)	8.1 (1.3)	8.4 (1.5)	13.6 (6.1)	14.4 (3.4)
4	8	7	9.0 (1.4)	8.4 (1.1)	9.0 (1.4)	13.4 (5.7)	14.0 (6.2)
5	5	4	9.0 (2.0)	9.0 (2.0)	9.0 (2.0)	7.0 (8.8)	16.8 (3.4)
6	4	4	8.5 (0.6)	8.5 (0.6)	8.5 (0.6)	13.0 (7.6)	17.3 (7.3)
7	5	5	8.8 (0.8)	9.0 (0.7)	9.4 (0.9)	14.4 (7.8)	17.0 (7.3)
8	4	4	9.3 (1.0)	9.5 (0.6)	9.8 (0.5)	9.0 (4.2)	12.5 (3.0)

Note: a = n of 5

Table 3

Participant (n = 5) Scores on Health, Coping/Cognitions, and Mood

Scale	Baseline (M; SD)	Exit (M; SD)
GSES	32.0 (4.9)	33.4 (3.3)
TMS – Total	30.0 (6.5)	19.0 (6.8)
PANAS – Positive Sub-scale	34.6 (8.4)	34.6 (10.1)
PANAS – Negative Sub-scale	21.0 (5.4)	22.8 (8.6)
PCS	12.6 (10.8)	23.6 (5.9)
FSS	38.0 (18.7)	37.4 (12.3)
CAMS-R – Total	32.8 (6.1)	30.8 (7.8)
CAMS-R – Attention	8.8 (1.3)	8.2 (1.5)
CAMS-R – Present Focus	8.6 (2.6)	8.6 (3.0)
CAMS-R – Awareness	7.2 (1.6)	7.4 (1.8)
CAMS-R – Acceptance	8.2 (1.8)	6.8 (2.2)
BPI – Worst Pain	5.4 (2.1)	6.8 (1.3)
BPI - Least Pain	1.8 (1.9)	3.2 (1.9)
BPI - Average Pain	4.2 (0.8)	5.2 (1.8)
BPI – Current Pain	3.2 (2.4)	5.4 (3.1)
BPI – General Activity	3.4 (3.9)	5.8 (2.9)
BPI – Mood	3.6 (3.9)	5.8 (1.8)
BPI – Mobility	4.8 (3.1)	6.0 (1.9)
BPI – Normal Work	4.6 (3.8)	7.3 (1.5)
BPI – Relations	3.6 (4.0)	4.8 (2.7)
BPI – Sleep	4.2 (4.1)	4.4 (3.8)
BPI – Enjoyment of Life	5.0 (3.5)	6.6 (2.6)

GSES = General Self-Efficacy Scale; PANAS = Positive Affect and Negative Affect Scale; PCS = Pain Catastrophizing Scale; FSS = Fatigue Severity Scale; CAMS-R = Cognitive and Affective Mindfulness Scale-Revised; BPI = Brief Pain Inventory

In response to Question One, participants reported a variety of expectations for the program: novel experience of self (n = 3; challenge to self, mind-body integration, meditation, and different kinds of experience), activity engagement (n = 3; new activity, having fun, and moving physically in new ways), stress relief (n = 5; relaxation, calming, outlet for stress), social support (n = 1; being with other people), and pain relief (n = 1; takes one's mind off the pain). Some of these themes are present in one participant's answer:

> Doing something new, something different, to move me in new ways and challenge me and doing something different and fresh. Being with other people…and I liked the idea of yoga, mind and body working in tandem, it really appeals to me, this kind of interaction. (ID#3)

Themes for Question Two (enjoyable aspects of the program) and Four (changes noticed during or after the program) were gleaned across the two questions due to considerable overlap in participant responses. The main themes to emerge included: present mindedness (n = 4 for Question Two and n = 4 for Question Four; increased focus, increased awareness, being in the moment, letting go, new way of being in old experience, increased awareness of body, increased

concentration), freedom from regular experience (n = 3 for Question Two and n = 0 for Question Four; maintain inward focus, refreshing, emotional relief, free from mental baggage, release from day-to-day stress, new lease on life), physical awareness or changes (n = 4 for Question Two and n = 2 for Question Four; intensity of physical experience, new postures, stretching, new sensations, strength building, focus on body parts, awareness of muscles, flexibility, new ways of moving, mobility), relaxation (n = 4 for Question Two and n = 3 for Question Four; calmness, breathing, feeling good, stress relief), investing in the self or achievement (n = 2 for Question Two and n = 2 for Question Four; doing the right thing for myself, time spent concentrating on self, looking forward to participating), environment (n = 2 for Question Two and n = 0 for Question Four; instructor, style of instructor, quiet, group membership, inclusive approach to yoga), taking the practice to everyday life (n = 0 for Question Two and n = 2 for Question Four; conscious of breathing, practicing at home, dealing with stress better), and pain relief (n = 0 for Question Two and n = 2 for Question 4; relief from overwhelming aspect of pain, release chronic pain).

With regard to changes in experiences of self and relaxation, one participant noted:

> It was a discovery for me…I had this ability to go to this spot where I was cut off from everyday hassles, troubles and mental baggage…I find that really exciting and new and something that has positive effects for myself. The meditation aspect, I'm talking about…I was really surprised at how, um how calm I was able to become in a short period of time, and as a complete novice, and how calm and relaxed and cut off from everything from the outside, I was able to become. And I find it really refreshing valuable and positive. (ID#3).

In addition, one person reported on the benefits of yoga in terms of pain relief:

> I think it just kind of made me more aware of my body and different aches and pains. I would say like even today for instance, I was in a lot of pain when I first came and now I feel a little bit better and it kind of just helps you kind of focus on an area and then kind of release the pain a little bit in that. So it's hard to do sometimes because sometimes pain can be very overwhelming. So its like you can somehow find a release. (ID#13)

In addition to the described therapeutic benefits, the group reported high levels of satisfaction with the program (n = 5) and that yoga was a positive therapeutic tool (n = 3), especially when the classes had more participants and were in depth. Furthermore, participants would recommend yoga for individuals with disabilities or would participate in a yoga program again (n = 5). Participants also felt that there were ways the program could be improved. In response to Question three, the five main themes regarding possible improvements included duration/frequency of class (n = 4; classes were too short, slow, infrequent), increased variety of postures (n = 3; a need for more stretching, a need for a slower pace, a need for a more in-depth approach), need for greater specialization (n = 2; greater specialization of postures), need for greater commitment of partici-

pants ($n = 2$; issues with late comers, attrition and a need to screen for participant commitment), and reduced distractions ($n = 3$; interruptions, posters, bright lights, noise).

Discussion

Although significant changes in health and well-being were not found on the surveys from baseline to exit, participants reported enjoying the yoga intervention, and the qualitative data indicated a number of therapeutic benefits (i.e., decreased stress, general pain relief). Despite our hypothesis not being confirmed by concrete changes in the quantitative data, the qualitative data provides preliminary evidence that the yoga program was well received and it supported personal growth beyond symptom reduction in individuals with SCI. Participants reported changes in physical functioning (e.g. strength building, stretching, decrease of pain, etc.) and an awakening of a deeper sense of self (e.g., increased self-awareness, having a new lease on life and being aware of things spiritually). The identified themes suggest that well-being improved from pre- to postintervention across several domains of functioning, including relaxation (e.g., calmness, breathing), achievement (e.g., eagerness to participate) and freedom from regular experience (e.g., new ways of being in old experience, letting go). The tools, resources, and support provided by the yoga program supported participants to overcome personal barriers in finding a greater connection to the self, sense of meaning, and present-minded experience. Not one participant reported feeling unsafe in the program or reported adverse physical effects such as pain, injury, or muscular strain. Yoga is an accessible and safe intervention post-SCI that warrants investigation through larger clinical trials to clarify the specific benefits it confers for individuals with SCI.

Limitations and Future Research

There are several factors that should be considered in the interpretation of these results. First, the program had a high rate of attrition, with six participants not completing the majority of sessions. Future studies should document reasons for attrition and provide strategies for minimizing its occurrence. The resulting sample size was small and it is possible that with larger numbers, changes would have been observed in the quantitative measures. Given the small sample size, it is also likely that saturation of themes was not achieved. Future work examining facilitators/barriers to engaging in these types of programs is warranted to best maximize program implementation and to increase participant satisfaction.

Second, because this pilot study was not controlled or randomized, it cannot be concluded that the self-reported changes resulted from the yoga, other aspects of the intervention (e.g. social factors, mindfulness, etc.), or undetermined factors. Adequately powered, randomized, controlled trials are needed to evaluate the impact of yoga programs for individuals with SCI. High-quality research trials will not only provide greater understanding on the efficacy and mechanisms of yoga, but they will also contribute to the literature and provide evidence for the usefulness of yoga programs in hospital and rehabilitation settings. Additionally, it is important to consider that the final assessment was made immediately after class 8, which have resulted in an acute effect lingering from the last class rather than a cumulative effect of changes resulting from training over the eight weeks. Future research may benefit from using a post-test design with a lapse of 48

hours between the final session and the posttreatment assessment.

Participants' qualitative reports suggest that the design of future yoga programs may benefit from applying principles of yogic philosophy to personal growth, as this was a primary benefit of the program identified in the analysis. Elements of the traditional eight limb yogic path (ashtanga yoga) have been incorporated into various research protocols to address both physical and mental health conditions; such philosophical principles offer tools that one can use to make meaning of, cope with and cultivate personal growth in the face of adversity (Balasubramaniam et al., 2013; Telles & Singh, 2013). For example, as participants begin to experience new ways of being or freedom from regular "mental baggage," as was reported in the present study, yogic concepts centering on self-study or introspection (*svadyaya*) and non-harming approach to practice and life (*ahimsa*) could be introduced as a springboard for further intrapersonal change. Investigating the impact of yoga interventions on constructs such as growth in the face of adversity, spiritual well-being, life satisfaction and QoL should also be pursued.

Therapeutic Recreation Considerations

All TR activities at the Toronto Rehabilitation Institute, including the yoga program, are guided by the Leisure Ability Model, which was designed with the belief that the end goal of TR services for clients is improved independence and satisfying leisure functioning, or a *leisure lifestyle* (Stumbo & Peterson, 2009). The term leisure lifestyle implies that the individual has the necessary skills, knowledge, attitudes, and abilities to participate successfully in and be satisfied with leisure experiences that are incorporated into his or her individual life pattern (Stumbo & Peterson, 2009). With regard to the yoga program, TR staff worked to implement this activity since it could easily be adapted for SCI for in-patients and for people living in the community. For in-patients, yoga was viewed as a safe and feasible leisure pursuit that people could potentially follow-up with once discharged into the community. Similarly, the program served as an introduction to community-dwelling persons with SCI to a leisure activity that provided both physical and psychological benefits.

The implementation of the program yielded a number of important insights for TR practice. In-patients were found to be less likely to complete the yoga program than people in the community due to discharge from the hospital during the program. Some participants stated that while they would have liked to continue with the program, their priorities were on settling back into the community. It is possible that out-patients may have made an initial commitment to complete the program despite transportation challenges, whereas in-patients may not have had to make this initial commitment. This finding highlights the need to optimize the timing of interventions in treatment planning and consider the program structure that most effectively facilitates the rehabilitation process. Introducing leisure options early post-injury/onset may contribute to better adjustment post-discharge, and subsequently, better long-term outcomes. In addition, short-term yoga interventions may improve attrition rates or providing participants with materials (e.g. videos, cds, handouts) to take home with them may support continued practice.

Conclusions

Overall, the findings of this pilot yoga intervention for SCI suggest that yoga practice may be associated with pos-

itive experiences for individuals with SCI along emotional (e.g. increased feelings of calmness and relaxation), mental (e.g. reduced levels of stress and freedom from "mental baggage"), and physical (e.g. strength building and increased physical awareness) dimensions. Many of the personal benefits participants identified in this study serve to ameliorate the multidimensional barriers to physical activity identified in the literature for individuals post-SCI including physical, psychological and social factors (Martin Ginis, Jorgensen, & Stapleton, 2012; (Martin Ginis et al., 2012; Vissers et al., 2008). Improvements in subjective well-being were gauged by indicators such as self-reported stress relief, freedom from regular experience and ability to be in the present moment, which all constitute changes in perspective and experience, and support the continued pursuit of health and personal growth. Since mental health obstacles can be a deterrent for individuals with SCI to engage in recreational activities (Loy, Dattilo, & Kleiber, 2003; Vissers, et al., 2008), it is imperative that post-SCI interventions target this barrier to rehabilitiation. It is possible that yoga interventions may simultanesouly address mutiple facets of experience (mental, emotional and physical experience) in a way that builds on current leisure activities. Many leisure activities focus on physical engagement (e.g. sports modified for accessiblity), novel experiences (e.g. camping experiences) or social support (e.g. peer groups) and in doing so, offer specialized programs that provide an opportunity for growth in one dimension of being.

The early post-SCI phase is a critical time in the rehabilitation process that shapes an individual's rehabilitation trajectory either positively or negatively (Pollard & Kennedy, 2007). This emphasizes the need for post-SCI interventions to be offered early in the recovery process and to be structured to respond to the unique needs of this population. For example, given the challenges with attrition in the context of a yoga intervention during the acute stages of care, future research should evaluate brief interventions in-hospital coupled with extensive guidance for home practice. In addition, future studies may consider taking preventative measures against attrition such as planning the intervention early in treatment or speaking with participants prior to commencing the protocol to identify possible barriers to continue attendance and corresponding solutions.

The present study offered a unique opportunity to provide a voice to members from the SCI community to describe what a desirable yoga program would consist of for them. Participants requested longer and more frequent classes as well programs with increased depth and specificity for this population. Future interventions should aim to be highly adaptable to the various needs of individuals with SCI and should address multiple dimensions of experience in order to build on programs that are traditionally offered in the leisure model. A large-scale, randomized controlled trial is recommended to yield empirical evidence for the efficacy of yoga post-SCI Considering the findings of the present study, future studies should respond to the specific concerns of this population such as attrition for longer-term interventions, the need to bridge concepts learned in class into daily life and adaptability to different individuals.

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Summary of Study 2 and rationale for Study 3.

The results from the qualitative data suggest that yoga may provide psychological and physical benefit to individuals with SCI, and may assist these individuals in finding a new way of orienting to concrete functional limitations. The participants reported a new way of experiencing their bodies and a novel sense of self, which points to the unique benefit of this program of helping individuals to find safety and peace in a body that may typically be experienced as distressing, foreign, or a reminder of trauma. As well, the participants experienced increases in mindfulness and were able to prioritize well-being and personal growth. Similar to Study 1, the participants found the program to be safe and pleasant, and recommended yoga for individuals with disabilities. These preliminary results suggest that yoga is a feasible mind-body intervention for individuals with SCI and provide a foundation for further investigation using a RCT design. However, the present study was limited by no control group and a small sample size, precluding the ability to draw any definitive conclusions regarding the efficacy of a yoga intervention for individuals with SCI.

The final study comprising this dissertation evaluated the impact of yoga for individuals with SCI using an RCT design and is presented in Chapter 5. Chapter 5 consists of three sections: the first section presents the objective and hypotheses; the second section presents the published manuscript, and the third section presents the qualitative data. The third section presents additional information about the qualitative data collection and includes a modified figure from the published article that synthesizes both the quantitative and qualitative data collection methodologies to assist with comprehension. The qualitative results were not published in the manuscript due to space constraints and this data was included in the

dissertation to provide a more holistic picture of the project and to provide depth regarding the experiences of the participants.

Chapter 5: Study 3, Randomized Control Trial Evaluating Yoga for Spinal Cord Injury

Section 1: Objective, Hypotheses, and Trial Design

Objective.

The purpose of this randomized controlled study was to conduct an evaluation of a six-week specialized yoga program for decreasing psychological inflexibility in individuals with SCI. This research project also evaluated pain (intensity, interference, catastrophizing), psychological experience (anxiety, depression, self-efficacy, resilience, posttraumatic growth), and third wave constructs (mindfulness, self-compassion) in individuals with SCI. The results of this evaluation aimed to provide insight into the benefits of yoga for individuals with SCI, point to suggestions for implementation into clinical practice, and guide future research.

Hypotheses.

The present study had one primary hypothesis (see point 1 below) and 3 secondary hypotheses (see points 2-4 below):

1. Participants of the yoga group would demonstrate greater improvements in psychological inflexibility from pre- to post-intervention, when compared to the wait-list control group. Specifically, it was predicted that scores on measures evaluating psychological inflexibility at post-intervention would be significantly lower in the yoga group compared to the wait-list control group.
2. Participants of the yoga group would demonstrate greater improvements in relevant psychological constructs and pain from pre- to post-intervention, when compared to the wait-list control group.

a) Specifically, it was predicted that scores on measures evaluating self-efficacy, posttraumatic growth, resilience, mindfulness, and self-compassion would be significantly higher in the yoga group compared to the wait-list control group, at post-intervention.

b) It was predicted that scores on measures evaluating depressive symptoms and anxiety would be significantly lower in the yoga group compared to the wait-list control group, at post-intervention.

c) For participants with ongoing chronic pain, it was predicted that scores on measures evaluating pain, pain interference, and pain catastrophizing would be significantly lower in the yoga group compared to the wait-list control group, at post-intervention.

3. Participants of the combined groups would demonstrate pre- to post-intervention improvements in all variables. Specifically, it was predicted that scores on measures evaluating pain, pain interference, pain catastrophizing, depression, anxiety and psychological inflexibility would be significantly lower from pre- to post-intervention and scores on measures evaluating self-efficacy, posttraumatic growth, resilience, mindfulness, and self-compassion would be significantly higher from pre- to post-intervention.
4. Analysis of qualitative interviews with the sample would reveal the positive impact of yoga on the lived experience of individuals with SCI with respect to perceptions of body, sense of self, future and purpose in life, and in experiences of daily life.

Section 2: Published Article

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ORIGINAL RESEARCH

Evaluation of a specialized yoga program for persons with a spinal cord injury: a pilot randomized controlled trial

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Objectives: The purpose of this randomized controlled trial was to evaluate the effects of a specialized yoga program for individuals with a spinal cord injury (SCI) on pain, psychological, and mindfulness variables.

Materials and methods: Participants with SCI (n=23) were outpatients or community members affiliated with a rehabilitation hospital. Participants were randomized to an Iyengar yoga (IY; n=11) group or to a 6-week wait-list control (WLC; n=12) group. The IY group participated in a twice-weekly 6-week seated IY program; the WLC group participated in the same yoga program, after the IY group's yoga program had ended. Pain, psychological, and mindfulness measures were collected at two time points for both groups (within 1–2 weeks before and after program 1 and at a third time point for the WLC group (within 1 week after program 2).

Results: Linear mixed-effect growth models were conducted to evaluate the main effects of group at T2 (postintervention), controlling for T1 (preintervention) scores. T2 depression scores were lower ($F_{1,18}$=6.1, P<0.05) and T2 self-compassion scores higher ($F_{1,18}$=6.57, P<0.05) in the IY group compared to the WLC group. To increase sample size and power, the two groups were combined and analyzed across time by comparing pre- and postintervention scores. Main effects of time were found for depression scores, ($F_{1,14.83}$=6.62, P<0.05), self-compassion, ($F_{1,16.6}$=4.49, P<0.05), mindfulness ($F_{1,16.79}$=5.42, P<0.05), mindful observing ($F_{1,19.82}$=5.06, P<0.05), and mindful nonreactivity, ($F_{1,16.53}$=4.92, P<0.05), all showing improvement after the intervention.

Discussion: The results indicated that a specialized 6-week yoga intervention reduced depressive symptoms and increased self-compassion in individuals with SCI, and may also have fostered greater mindfulness.

Keywords: spinal cord injury, Iyengar yoga, depressive symptoms, self-compassion

Introduction

Sustaining a spinal cord injury (SCI) is a life-changing experience that can result in motor, sensory, bladder, bowel, sexual, and autonomic impairments. These impairments contribute to a high number of secondary health conditions, including psychological disorders and chronic pain.[1,2] Rehabilitation in the post-SCI period is often focused on physical therapies and psychological interventions to support the recovery process, which may include access to resources or services to foster physical activity and community engagement (eg, therapeutic recreation). The post-SCI period requires a reorientation to meaningful life activities and flexibility engaging with new challenges in the context of abrupt physical and emotional changes.[3]

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Psychological distress and pain

The rates of psychological disorders (eg, major depressive disorder and generalized anxiety disorder) after SCI range from 17% to 25%, highlighting this population's vulnerability to psychological distress,[4] which is considerably higher than the general population.[5,6] A longitudinal study evaluating psychological health in individuals with SCI from 12 weeks to 10 years postinjury demonstrated that the rates of anxiety and depression were relatively stable.[7] Not surprisingly, the relationship between physical and mental health is correlated for individuals with SCI, such that those with higher levels of physical symptoms, such as pain or fatigue, also report greater psychological distress, such as depressive and anxiety symptoms and poorer quality of life (QoL).[8–10]

Eighty-one percent of individuals with SCI report chronic pain up to 5 years postinjury, which can impact physical, social, psychological, and functional facets of living.[11,12] Pain in individuals who have sustained SCI is classified by the International SCI Pain Classification according to three tiers.[13] The first tier classifies the type of pain (eg, nociceptive, neuropathic, or "other"), and the second tier classifies the subtype of pain. Subtypes of nociceptive pain are classified as musculoskeletal, visceral, or "other", and subtypes of neuropathic pain are classified as "at level SCI", "below level SCI", and "other". The third tier includes the primary pain source and pathology, and it is recommended to consider pain intensity also. This system parallels earlier systems that classify pain according to etiology, pathology, location, severity, and quality, and according to four dimensions: musculoskeletal, visceral, neuropathic, or "other" types, all of which significantly impact QoL.[1] Pain is also classified relative to the level of the spinal injury: pain at or below the level of the injury tends to be neuropathic in nature, and depending on the completeness of the lesion may be akin to phantom pain. This pain is often referred to the lower limbs via the convergence and summation of inputs (somatic and visceral) in higher central nervous system structures. Pain above the level of the injury tends to be musculoskeletal in nature, and may arise from overuse. Musculoskeletal pain in individuals with traumatic SCI has been reported to be the most frequently reported type of pain.[12]

According to the fear-avoidance model of chronic pain, pain catastrophizing, pain-related fears, and pain-related anxiety all contribute to the development and maintenance of chronic pain through a network of escape and avoidance behaviors, behavioral inactivity, the deconditioning syndrome, and disability.[14] Pain-related cognitions, such as pain catastrophizing, are recognized as negatively impacting pain-related experiences and functional ability in individuals with SCI.[15] Both active and passive pain-related coping statements have been correlated with pain intensity and unpleasantness in individuals with SCI in a pilot, longitudinal study, and it is recommended that pain-coping styles be addressed in the rehabilitation process to tailor treatments best to different response types.[16]

Bolstering inner resources

Current rehabilitation models typically focus on symptom reduction or health vulnerabilities, but there is increasing recognition that augmenting inner resources, such as self-efficacy, posttraumatic growth, and resilience, may serve as a buffer from challenging experiences and/or create positive psychological change after SCI.[17–20] These constructs may also function in secondary synergistic and interconnected relationships for individuals with SCI. A cross-sectional study employing a convenience population found that self-efficacy was positively correlated with resilience while in hospital and at 3 months post-SCI, and that levels of self-efficacy predicted levels of resilience while in hospital.[21] Similarly, self-efficacy, as well as low levels of depressed mood, predict resilience in individuals with SCI at discharge and 6 months postdischarge from an inpatient rehabilitation setting into the community.[22] It has been recommended that rehabilitation strategies enhance self-efficacy by strengthening the relationship between behaviors and perceived goals through increased self-monitoring and self-awareness.[4]

Posttraumatic growth refers to the profound self-transformation that can emerge from suffering, pain, and trauma, and posits that growth and adaptability can be natural consequences of traumatic experiences.[23] A model examining posttraumatic growth, depression, demographics, and injury characteristics in a community-based, cross-sectional study found that most individuals with SCI experienced some experiential growth postinjury, and these authors recommended further development of conceptual models of this construct in the context of SCI.[23] Also, posttraumatic growth has been associated with higher levels of psychological distress in community-based individuals with SCI, highlighting it as a potentially useful target for improving well-being in this population.[7]

A construct related to posttraumatic growth is resilience, which refers to adaptive coping and the ability to respond flexibly to adverse life events in a positive and growth-promoting way.[24] This construct is particularly important in health conditions that can render an individual helpless or vulnerable to developing secondary psychological

conditions. Resilience has been found to mediate the impact of pain on depression, such that resilience reduced the effect of pain severity on depression and was also found independently to predict both depression (negatively) and posttraumatic growth (positively).[18] Latent growth mixture-modeling analysis of a longitudinal study evaluating individuals with SCI at 6 weeks, 3 months, 1 year, and 2 years found that resilient individuals had fewer SCI-related QoL problems, evaluated stressors as challenges rather than threats, had greater acceptance and did not cope by using behavioral avoidance.[25] Higher levels of resilience have also been associated with higher levels of self-efficacy, internal locus of control, and lower levels of psychological distress in community-dwelling adults with SCI in a cross-sectional postal survey.[17] Increasing resilience may be a useful target for rehabilitation and have secondary gains in terms of fostering positive growth post-SCI.[18]

Constructs embedded in third-wave therapies, such as psychological flexibility, mindfulness, and self-compassion, have origins in Buddhist and Eastern contemplative philosophies, and are being incorporated into contemporary psychological and health interventions.[26–29] A common thread among these constructs is the disentanglement of pain and suffering and shared attitudes of openness, nonjudgment, and present-mindedness. Psychological flexibility is negatively associated with depression, pain-related anxiety, physical disability, and psychosocial disability in individuals undergoing interdisciplinary treatment for chronic pain.[30] It has been suggested that psychological flexibility involves a willingness to experience distressing emotions or pain, rather than avoiding or "pushing up" against them, with consequent reductions in suffering and improvements in daily functioning.[30] Similarly, mindfulness has been found negatively to predict pain intensity, pain catastrophizing, pain-related fear, pain hypervigilance, negative affect, and functional disability in chronic pain patients.[31] The role of acceptance is an important factor in healthy psychological adaptation to SCI,[32] and acceptance cognitions were associated with better mental health in a prospective study evaluating community-dwelling individuals with SCI over time.[33] Self-compassion has been associated with self-efficacy and resilience in individuals with spina bifida,[19] and is a significant predictor of positive and negative affect, pain catastrophizing, and pain disability in individuals with chronic pain and obesity.[29] To date, there have been no studies to evaluate self-compassion or psychological flexibility in the context of a rehabilitation intervention or as theoretically relevant for an SCI population.

Yoga as a health intervention

Focus groups consisting of individuals with SCI and physicians indicate that there is a need for highly individualized treatment approaches and a desire for complementary health therapies for SCI-related pain.[34] Yoga is an ancient mind–body practice dating back to 3,000 BC, and is traditionally defined as cultivating deep concentrative awareness, predominantly through the use of physical postures. The postures are a common thread through various schools of yoga, and are the primary focus in contemporary uses of yoga.[35] In modern health care, yoga is gaining acclaim for improving health and well-being, and has been evaluated for both acute and chronic conditions in a variety of clinical populations.[36,37] There is evidence from randomized controlled trials (RCTs) that yoga is effective in the treatment of a variety of chronic conditions as either a stand-alone treatment or as an adjuvant therapy. Yoga has been shown to be effective in reducing pain and disability for individuals with low-back pain,[38] neck pain,[39,40] knee and hand osteoarthritis,[41,42] and rheumatic disease and fibromyalgia.[43,44] RCTs have also demonstrated that yoga practice results in improvements in mental health (depression, anxiety, self-efficacy, psychological flexibility in relation to posttraumatic stress disorder, and sleep),[45–47] and fatigue- and mood-related impacts in multiple sclerosis.[48–50] Results from several pilot studies have shown that yoga also positively impacts other facets of psychological experiences, such as pain catastrophizing,[51] self-compassion,[52] and mindfulness[51] in clinical and nonclinical populations.[45,46,47,51–57] There is qualitative evidence for the positive impact of yoga on belongingness, sense of connectedness, self-transformation, sense of purpose, and acceptance of changes to one's body in individuals who have sustained a stroke,[58] which may be relevant to individuals with SCI who must face new limits in the context of their injury. In addition, the role of stress in the development, maintenance, and exacerbation of chronic diseases is now widely accepted, and thus lifestyle factors that remediate stress, such as yoga, are of increasing value.[59]

Although there is an abundance of research evaluating the impact of yoga on chronic conditions and limited mobility, there is sparse research on the use of yoga for SCI. To date, there has been only one pilot study outlining the potential benefits of a yoga intervention for individuals with SCI, in which descriptive qualitative analysis revealed that participating in a specialized 8-week yoga program provided therapeutic benefits in emotional (increased present mindedness), mental (decreased stress), and physical domains (decreased pain).[60] A case report evaluating a twice-weekly, 12-week yoga intervention for an individual with SCI suggested that

yoga may result in improvements in balance, strength, endurance, flexibility, posture, and functional outcomes.[61] Yoga has also yielded benefits in individuals with scoliosis with respect to the degree of curvature of the spine, and there are now well-documented benefits for yoga reducing functional disability for chronic back pain.[38,62] It has been suggested that Iyengar yoga (IY) be integrated into SCI rehabilitation therapies to increase physical functioning and to cultivate a positive mind–body experience.[63] IY has been selected as an appropriate form of yoga for individuals with chronic conditions and mobility restrictions, as it emphasizes careful alignment of the muscles and bones in each posture, in order to execute each pose with optimum safety and awareness, and to minimize the risk of injury or strain.[63,64] This type of yoga is based on the principles of precise alignment, purposeful sequencing, and specific timing to hold postures.[65] Yoga programs may be easily modified for varying degrees of impairment and mobility, making yoga a highly accessible intervention for this population. The preliminary results on yoga from research trials suggest that yoga may provide therapeutic utility for individuals with SCI, but rigorous, methodologically sound RCTs are needed to evaluate the effects of yoga for this population formally.

Objectives

The purpose of this pilot randomized controlled study was to conduct an evaluation of a 6-week specialized IY program for improving psychological factors, pain and related variables, and mindfulness in individuals with SCI. The present study had one primary hypothesis and two secondary hypotheses. Firstly, participants in the IY group would demonstrate greater improvements in psychological inflexibility from pre- to postintervention compared to the wait-list control (WLC) group. Specifically, it was predicted that scores on measures evaluating psychological inflexibility at postintervention would be significantly lower in the IY group compared to the WLC group. Secondly, the IY group was expected to show greater improvements in pain and psychological measures from pre- to postintervention compared to the WLC group. Specifically, it was predicted that scores on measures evaluating self-efficacy, posttraumatic growth, resilience, mindfulness, and self-compassion would be significantly higher in the IY group compared to the WLC group at postintervention. It was predicted that scores on measures evaluating depressive symptoms and anxiety would be significantly lower in the IY group compared to the WLC group at postintervention. For participants with ongoing chronic pain, it was predicted that scores on measures evaluating pain, pain interference, and pain catastrophizing would be significantly lower in the IY group compared to the WLC group at postintervention. Thirdly, when combining the two groups we expected to see significant improvement on all measures from pre- to postintervention. Specifically, it was predicted that scores on measures evaluating psychological inflexibility, depressive symptoms, anxiety, pain, pain interference, and pain catastrophizing would be significantly lower from pre- to postintervention and scores on measures evaluating self-efficacy, posttraumatic growth, resilience, mindfulness, and self-compassion would be significantly higher from pre- to postintervention.

Materials and methods

Trial-design overview

This two group, unblinded, crossover, pilot RCT was designed in accordance with the CONSORT guidelines, approved by the research ethics boards at the University Health Network (UHN)/Toronto Rehabilitation Institute (TRI) and York University, and registered at ClinicalTrials.gov (NCT02656927). This study employed an external pilot design, in order to provide preliminary evidence on the efficacy of a yoga intervention for individuals with SCI, and to provide a foundation for a larger-scale RCT.[66,67] Recruitment and retention for a previous trial evaluating yoga for individuals with SCI had low retention,[60] and so this pilot study would provide information on whether it is possible to recruit and retain individuals with SCI in compliance with an RCT design. This pilot study would also describe the intervention and its implementation, as well as determine safety and tolerability.[68] This RCT used a parallel design with a crossover feature, such that the WLC group received the yoga intervention after it had been provided to the IY group. The trial evaluated the effects of a specialized IY intervention versus a WLC group on psychological well-being, pain and related variables, and mindfulness factors. Participants (n=23) were randomized to one of two groups in a 1:1 ratio. Participants assigned to the modified IY (n=11) group received a twice-weekly, 6-week IY intervention; participants assigned to the 6-week WLC (n=12) group received the same 6-week IY intervention, starting the week after the IY group had completed the yoga intervention.

It has been suggested that RCTs are not always categorical according to the pragmatic–explanatory dimension, and rather fit along a continuum in order best to evaluate a specific intention or research question.[69] This study sought to assess meaningfully the impact of a yoga intervention using a pragmatic design with explanatory

features. Participant recruitment followed a pragmatic design, such that all participants with a broad range of SCI or SC-related conditions, irrespective of comorbidities or past compliance, were included. The active intervention adhered to explanatory models of RCTs in that the yoga program was highly specialized for individuals with SCI, was rooted in classical physical and contemplative traditions of yoga, and was taught by yoga instructors with high-level certifications. However, the WLC group received standard care if they were outpatients or no treatment if they were community members, which is consistent with a pragmatic design. Similarly, the design for data collection also used both pragmatic and explanatory factors: data collection was done via standardized questionnaires rather than administrative databases (explanatory), and qualitative interviews were used to assess meaningfully the impact of the yoga intervention (pragmatic). Extensive training was not required to administer these questionnaires (pragmatic; no biological or physiological parameters). Special strategies were not used to maintain or monitor compliance and adherence, other than attendance, which was in line with a pragmatic design. In summary, this study used primarily a pragmatic design with explanatory features to balance feasibility of testing a yoga intervention for a complex population under usual conditions in a hospital and rehabilitation setting with experimental rigor.

Participants

The RCT took place at the TRI's UHN Lyndhurst Centre (LC) Brain and Spinal Cord Rehabilitation Program. LC staff circulated/posted flyers describing the yoga study and recruiting participants. Recruitment was also done via email, announcement board (including electronic versions, eg, postings on websites), and verbally at various interprofessional meetings. TRI staff were provided with the inclusion and exclusion criteria for participation in the study for preliminary screening. A member of the research team completed a formal screen and determined eligibility for participation for individuals (n=45) who expressed interest in participating in the study. Of the 45 participants that were recruited, only 23 were eligible and available to participate. One of these participants was not able to provide a physician's note and so this person was excluded (n=22).

The yoga program was offered to outpatients on the waiting list for the activity room and other individuals with SCI who were connected with the LC, which included persons interacting with Spinal Cord Injury Canada (http://sci-can.ca), an SCI consumer-advocacy organization. Specific inclusion criteria for participation were the presence of an SCI or spinal-related condition (all levels of injury), being aged 18 years or older, the ability to speak and read English, ability to commit to twice-weekly 1-hour yoga classes for 6 weeks, a referral from a clinician on the interdisciplinary team (if they were an outpatient at the LC), a sitting tolerance of 1 hour, ability to participate in gentle physical activity for 1 hour, awareness of health contraindications (ability to practice safely), and provision of a note from a physician indicating that it was safe for them to participate in a physical activity intervention, such as yoga. Gentle physical activity referred to actively engaging in low-impact activity in a purposeful and careful manner. Participants were excluded if there were not medically stable, had preexisting medical contraindications (determined by physician), had cognitive limitations or language-comprehension issues that would impact participation (determined by physician), or had had regular yoga practice in the previous 6 months (approximately once per week for a minimum of 1 month). The classification of SCI was broad, and included demyelinating diseases of the central nervous system or developmental/birth insult to the SC.

Persons who met eligibility requirements and who continued to express an interest in hearing more about the study were invited to a group-information session or to an individual meeting with a research team member (KC). Participants (n=23) were informed of the risks and benefits associated with participating in the study, and provided written, informed consent to participate. The flow of participants through the study is shown in Figure 1, and participant demographics can be seen in Table 1. Due to the small sample size, Fisher's exact test was conducted to evaluate pretreatment differences. Ethnicity differed across the two conditions ($P<0.05$), but education and socioeconomic status did not. Visual inspection of the frequency data revealed that there were more participants with Caucasian heritage in the control condition, but representation of zero participants in several conditions precluded the ability to calculate odds ratios across ethnicities. Ethnicities were collapsed into Caucasian versus non-Caucasian, and Fisher's exact test revealed a significant difference across ethnicity ($P<0.05$). The odds of being in the IY group were 11.67 (95% confidence interval 1.53–89.12) times higher for non-Caucasian than Caucasian participants. Injury characteristics did not differ between the groups: complete/incomplete, traumatic/atraumatic, paraplegia/tetraplegia/ambulatory, or in the use of mobility aids. The two groups did not differ in age ($t_{12.95}=-1$, $P>0.05$), height ($t_{20}=-0.41$, $P>0.05$), or weight ($t_{20}=-2$, $P>0.05$).

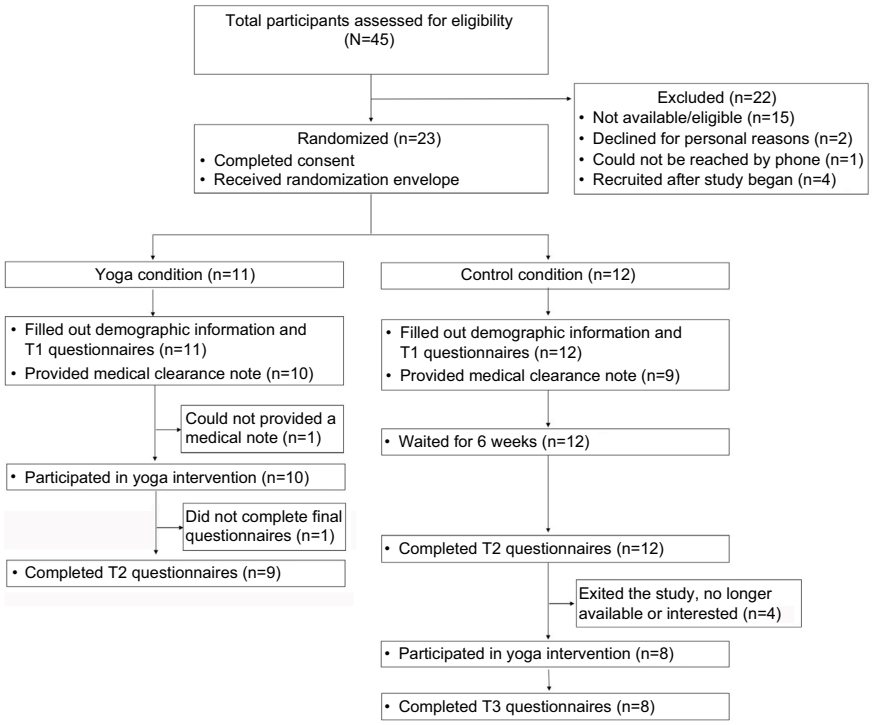

Figure 1 Flow of participants through the study

Procedure and interventions

The time sequence of data collection relative to the intervention is shown in Figure 2. Data were collected at two time points for both groups and at a third for the WLC group: pre- (T1) and post- (T2) yoga intervention for the IY and WLC groups, and T3 after the WLC group had received the yoga intervention. Each assessment time point was approximately 1 hour long and occurred within 1–2 weeks of the beginning or ending of the yoga programs. Participants were provided with a questionnaire package to fill out independently at a table. A research-team member was available to answer questions. At T1, participants filled out the questionnaire package (see "Measures" section), and forms regarding demographic information (eg, ethnicity, income), SCI-related health information, medication, and a scale measuring secondary health conditions (Spinal Cord Injury Secondary Conditions Scale – modified).[70,71] There were no semistructured questions. The questionnaire package took approximately 20–30 minutes to complete.

At T2, participants in the IY group had the option of remaining after the final yoga class to complete the T2 questionnaires or setting up an individual meeting with a member of the research team within the first week after the yoga program. Participants in the WLC group attended a separate T2 data-collection session or set up an individual meeting with a member of the research team. At T3, participants in the WLC group filled out the questionnaires after the final yoga class. Participants with any fine-motor difficulties were offered assistance by a member of the research team for recording their answers. All the data were deidentified, and each participant's data was coded. Original participant names and codes were recorded in a password-protected document. All data were stored on the TRI research server, and hard-copy materials were kept in a locked cabinet at the LC.

Sample-size estimation

Sample-size estimation indicated that 24 participants (12 per group) would be required to demonstrate a moderate effect

Table 1 Demographics of the sample (n=22) by group

Demographic information	Yoga group (n=10), mean (SD)	Control (n=12), mean (SD)
Age (years)	47.9 (19.51)	54.75 (10.11)
Height (cm)	165.33 (6.83)	167.43 (15.13)
Weight (kg)	66.18 (10.42)	78.43 (16.89)
	n (%)	**n (%)**
Injury origin		
Traumatic	7 (70)	8 (66.7)
Non-traumatic	3 (30)	4 (33.3)
Completeness		
Complete	2 (20)	5 (41.7)
Incomplete/disease-related	8 (80)	7 (58.3)
Level of injury		
Paraplegia	6 (60)	4 (33.3)
Tetraplegia	0	4 (33.3)
Ambulatory/unspecified	4 (40)	4 (33.3)
Mobility device		
Wheelchair	7 (70)	7 (58.3)
Walker	1 (10)	2 (16.7)
Cane/poles	2 (20)	3 (25)
Race/ethnicity*		
African-Canadian	1 (10)	0
South Asian	4 (40)	0
East Asian	1 (10)	1 (8.3)
Caucasian	3 (30)	10 (83.3)
Hispanic	1 (10)	0
Other	0	1 (8.3)
Annual income (CA$)		
<25,000	6 (66.7)	4 (36.4)
25,000–39,000	1 (11.1)	2 (18.2)
40,000–59,000	1 (11.1)	1 (9.1)
60,000–100,000	1 (11.1)	2 (18.2)
>100,000	0	2 (18.2)
Level of education		
High school	2 (20)	2 (16.7)
University/college	8 (80)	9 (75)
Postgraduate school	0	1 (8.3)

Note: *$P<0.05$ (Fisher's exact test).
Abbreviation: SD, standard deviation.

size of 0.7 in the main outcome variable (psychological inflexibility), using a type I error rate of 0.05 and a power of 0.9. Sample-size estimation was calculated using G*Power 3 (3.1.9.2; Universität Düsseldorf, Germany), based on a between-group analysis of covariance design with two groups and one covariate.

Randomization

A randomization schedule was generated (randomization.com) in advance of the study by a member of the research team, who was not directly involved with the clinical management of the participants or in the research project. Randomization was blocked according to sex, and specified the group (IY or WLC) to which each prospective participant would be allocated upon enrollment into the trial. An opaque envelope containing the participant number and group assignment was prepared, sealed, and numbered for each potential participant. This envelope was opened at the time that each participant was randomized.

Ethical considerations

Individuals with SCI represent a vulnerable population and are a relatively overresearched group. Respect for their dignity was ensured through a careful consent process and with a thorough explanation of risks and possible benefits of participation. As mentioned earlier, no special strategies were used to maintain enrollment throughout the study. Confidentiality for participant privacy and secure data storing was maintained at all phases of the research process. In order to reduce barriers to participation for low-income individuals, transport tokens were provided, which promoted values of inclusion and equality. There was no deception involved in this research project.

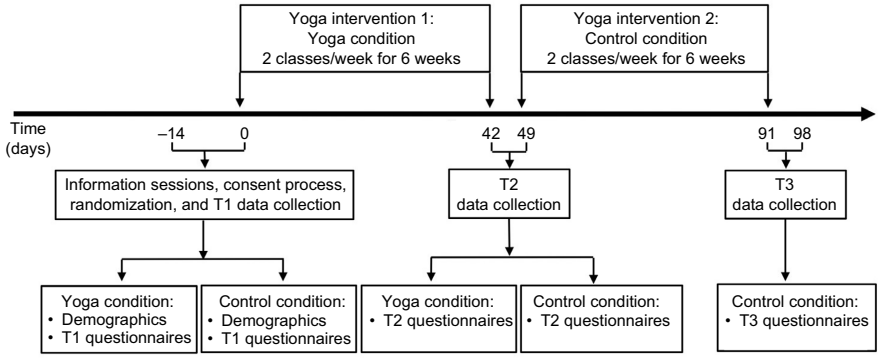

Figure 2 Temporal sequence of the yoga interventions and data collection for both groups

Iyengar yoga group

After informed, written consent to participate had been obtained, participants randomized to the IY group took part in a 6-week intervention of IY at a frequency of two 50- to 60-minute classes per week (approximately 12 hours total). The 6-week yoga intervention was held at the Therapeutic Recreation Department at the TRI/LC's Brain and Spinal Cord Rehabilitation Program. The duration of 6 weeks, dosage of two classes a week, class length of 60 minutes and total intervention hours (12) was decided in alignment with the yoga literature,[72] and participants were encouraged only to practice basic poses that had been determined safe and after they had practiced them with supervision for several classes.[64] The classes were offered at no cost to the participants. The program was designed and taught by certified IY teachers, who were certified as intermediate senior 1 and intermediate junior 3 teachers of IY. Both of these certification levels are advanced, and involve multiple (two to four) trips to study at the Ramamani Iyengar Memorial Yoga Institute in Pune, India. Also, both teachers had 1) 22–26 years of teaching yoga, 2) advanced training in therapeutics of IY, 3) knowledge of yoga philosophy[35] and mindfulness-based practices, and 4) experience teaching yoga to limited-mobility populations. The class structure and content was based upon a book written by one of the teachers on a major yoga-philosophy text[35] and a manual previously used in a research trial evaluating yoga for individuals receiving complex care in a hospital setting.[52] An LC recreation therapist was available for consultation during all the classes.

Wait-list control group

After informed, written consent to participate had been obtained, participants randomized to the WLC group received no additional treatment. They were informed that they would receive the same 6-week IY intervention after a period of 6 weeks, and should not start yoga practice while waiting for the intervention to commence.

Yoga program

The classes involved a broad and integrated approach to yoga and included breathing practices (prāṇāyāma), physical postures (āsana), yoga philosophy (jñāna), mindfulness (smṛti sādhanā), and meditation/relaxation (dhāraṇā, dhyāna) techniques. There is flexibility in the school of IY as to how the physical practices are applied (gentle versus more vigorous), and these can be easily modified according to the needs of the student. IY typically uses a variety of props as aids in performing āsanas (postures), and this intervention used blankets to accompany principles of right action and alignment, in particular with regard to posture and for the action of lifting the chest. The emphasis on self-development and awareness is inextricably linked with the physical āsanas, and the practice is conceptualized as a transformative process for mental, physical, and spiritual health, with consequent gains in energy and vitality.[73]

Each class opened with a brief philosophy concept (~5 minutes, see Table 2), which was based on relevant contemplative and reflective practices from Patañjali Yoga Sūtras that focused on self-study, personal development, observances, ethical discipline, and attitudes of acceptance, among others.[35] This was followed by a concentration practice (dhāraṇā), with breathing, mindfulness, and relaxation components (~10–15 minutes). The āsana practice (~20–30 minutes) focused on upper-body postures that were sequenced in a purposeful way to build on awareness and actions learned in previous poses. The sequences consisted of preparatory arm work, ūrdhva hastāsana (single arm and both arms), baddhanguliyāsana, garuḍāsana, hastāsana with arms out to the side, gentle twist to either side, and neck stretch to either side and forward, using baddhanguliyāsana bound fingers. In addition, breath–movement coordination was used to transition between poses and to encourage sustained inward focus. There was a focus in each class on the principles of lifting the heart/chest, centering the head over the spine, and creating space in the spinal vertebrae. Repetition was emphasized so that participants could learn the sequence by the end of the study. Participants who required hands-on assistance were attended to by a yoga teacher. Participants were encouraged to push gently the edge of comfort and actively engage their muscles to build strength and flexibility, while also practicing safely within personal limits with respect to pain and fatigue. Safe variations or modifications were provided to participants with more limited arm movement, so that they could participate in all parts of the āsana portion of the class. One participant with tetraplegia used a table for support in some āsanas. Finally, the class ended with another concentration (dhāraṇā, dhyāna) component, with used principles of mindfulness (smṛti sādhanā), breath awareness (prāṇāyāma), philosophy (jñāna), or imagery.

Measures

Main outcome measure: Acceptance and Action Questionnaire

The Acceptance and Action Questionnaire (AAQ)-II is a seven-item scale that evaluates psychological inflexibility

Table 2 Yoga philosophy concepts by class

Class	Concept	Explanation
1	Witness consciousness and ahimsā (nonviolence); Sūtra 2.35	Practicing "being with" challenging experiences without pushing them away or clinging to personal narratives. Practicing in a way that is safe and supportive. Doing without over- or underdoing. Using the right amount of effort for growth.
2	Abhyāsa (repeated practice); Sūtra 1.12	The important of repeating practice to yield benefits in the mind and body.
3	Satya (truthfulness); Sūtra 2.36	Honestly examining one's experience to better understand one's "starting point" and using yoga practice as a springboard for positive change.
4	Concept review: ahimsā, abhyāsa, satya; Sūtras 1.12, 2.35, 2.36	Review and integration of preliminary concepts and emphasis of self as a friend and the use of compassion in practice.
5	Breath awareness to balance the nervous system and calm the mind; Sūtra 1.34	Pain management through relaxation, training the attention to see tension patterns in the body, using imagery and visualization.
6	Sthira sukham āsanam; Sūtra 2.46	Finding a balance between steadiness/stability/effort with ease/joy/relaxation. Link to teaching on ahimsā and dosing of effort in activity and rest.
7	Ekā gra (one pointed concentration); Sūtra 1.32	Training attention and concentration by returning to a point of focus repeatedly, with a calming effect on the mind.
8	Meditation for relaxation, contemplation on the heart; Sūtra 1.36	The heart as a resource, refuge, and source of inner luminosity.
9	Review of Ekā gra and breath as nourishment; Sūtras 1.32, 1.34	Tying together concepts from previous classes regarding one pointed focus and the breath as calming and revitalizing. Training attention to return to the breath repeatedly, as a way to regulate the body–mind.
10	Aparigraha and santoṣa; Sūtras 2.39, 2.42	Effort to make positive change in the body can be helpful to move toward health, but care is needed to prevent agitation in striving/grasping. Importance of cultivating contentment (santoṣa) with current abilities/body.
11	Śodhana, śoṣana, śobhāna, śamana; Iyengar's teaching on the four elements of practice	Śodhana, purification through active āsana to lift heavy states of body–mind; śoṣana, integration of practice, doing one's best, which changes over time; śobhāna, excellence and auspiciousness, good intention to do practice with care and good effort, śamana, practice as a vehicle for relaxation and calmness; one should feel better after practicing.
12	Śodhana, śoṣana, śobhāna, śamana; Iyengar's teaching on the four elements of practice and taking the practice to life	Repetition of previous class content and explaining how to work with these elements of practice individually, should participants want to keep practicing after the program is completed.

and experiential avoidance, which are constructs that are associated with acceptance and commitment therapy.[74] Items are scored from 1 (never true) to 7 (always true), and total scores range from 7 to 49, with higher scores reflecting higher levels of psychological inflexibility. The AAQ-II has good internal consistency (α=0.84 [0.78–0.88]) and good temporal stability (3- and 12-month test–retest reliability, α=0.81 and 0.79, respectively). Higher levels of psychological inflexibility, as measured by the AAQ-II, are associated with higher scores on measures of depression (r=0.61–0.71), anxiety (r=0.49–0.61), stress (r=0.57), and ill health (r=0.3–0.71; good concurrent validity), and higher scores on the AAQ-II are positively associated with higher scores on a measure of thought suppression (r=0.63; good convergent validity).[74]

Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS) is a 14-item self-report questionnaire that measures symptoms of anxiety (7 items) and depression (7 items).[75] For each item, respondents are asked to select one from among four possible choices (scored from 0 to 3) that best describes how they have been feeling over the past week. The HADS yields anxiety (HADS-A) and a depression (HADS-D) subscale scores, each with a maximum total score of 21. Internal consistency for the anxiety and depression subscales showed Cronbach's α-values of 0.8–0.93 for the HADS-A and 0.81–0.9 for the HADS-D.[76,77] Concurrent validity of the HADS is very good, as measured by correlation coefficients of 0.62–0.73 for the HADS-D with various well-validated depression scales (eg, Beck Depression Inventory, Symptom Checklist 90 – depression subscale) and correlation coefficients of 0.49–0.81 for the HADS-A with various well-validated anxiety measures (eg, Spielberger State-Trait Anxiety Inventory, Symptom Checklist 90 – anxiety subscale).[76,77] The scale has shown good internal consistency when used with an SCI population (Cronbach's α=0.85 for the anxiety subscale and α=0.79 for the depression subscale), though some items present as complex in this population (eg, "I can sit at ease and feel relaxed").[78]

General Self-Efficacy Scale

The General Self-Efficacy Scale (GSES) is a ten-item construct that assesses optimistic self-beliefs regarding one's perceived ability to cope with a variety of daily hassles and stressful life events.[79] Items are scored using a 4-point scale: 1 (not at all true) to 4 (exactly true). Total scores range from 10 to 40, with higher scores reflecting higher perceived self-efficacy. The GSES demonstrates high internal consistency (α=0.86), unidimensionality, and construct validity.[80] It has been negatively correlated with anxiety (r=–0.42 to –0.43) and depression (r=–0.33 to –0.46) and positively correlated with optimism (r=0.52–0.6).[80] The GSES has been used in the SCI population, and the construct of self-efficacy has been tied to a number of favorable outcomes post-SCI.[81–84]

Posttraumatic Growth Inventory

The Posttraumatic Growth Inventory – short form (PTGI-SF) is a ten-item measure evaluating posttraumatic growth, a construct involving positive adaptability and self-transformation after trauma.[85] The PTGI-SF asks respondents to consider how much various facets of their experience have changed as a result of their trauma according to a 6-item Likert scale, ranging from 0 ("I did not experience this change as a result of my crisis") to 5 ("I experienced this change to a very great degree as a result of my crisis"). Scores range from 0 to 50, and higher scores reflect higher levels of posttraumatic growth. Both the original and the SF of this scale have five factors (relating to others, new possibilities, personal strength, spiritual change, and appreciation of life), and the SF has good internal consistency (total scale coefficient α=0.89 and subscale α=0.72–0.84).[85,86] The PTGI-SF has good concurrent validity; scores on the PTGI-SF are negatively correlated with scores on measures of depression and positively correlated with scores on measures of QoL and resilience.[87]

Connor–Davidson Resilience Scale

The Connor–Davidson Resilience Scale (CD-RISC) is a self-report measure of resilience that evaluates the ability to adapt positively to stressful situations or experiences.[88] The abridged version consists of ten items (CD-RISC-10), which measure the ability to tolerate experiences of change, personal problems, illness, pressure, failure, and painful feelings. Respondents are asked to read each item and indicate the extent to which an item has been true for them over the past month using a 5-point Likert scale from 0 (not true at all) to 4 (true nearly all the time). The CD-RISC-10 has good internal consistency, with an α-coefficient of 0.85.[88,89] The original demonstrates good convergent validity: scores on the CD-RISC are positively correlated with scores on a measure of hardiness (r=0.87) and negatively correlated with scores on measures of stress (r=–0.76) and vulnerability (r=–0.32).[89] Scores on the CD-RISC-10 have high correlation with scores on the 25-item version (r=0.92). There is some preliminary support for construct validity for the CD-RISC-10: scores on CD-RISC-10 items have been shown to moderate the relationship between retrospective reports of childhood abuse and current psychiatric symptoms.[88] The CD-RISC-10 has been used in research studies evaluating individuals with SCI.[17,90]

Self-Compassion Scale

The Self-Compassion Scale (SCS)-SF is a 12-item self-report questionnaire that measures levels of self-compassion or the ability to hold one's feelings of suffering with a sense of warmth, security, or concern.[91] The SCS-SF has been demonstrated to comprise a unidimensional construct of self-compassion, and has six subscales: self-kindness, self-judgment, common humanity, isolation, mindfulness, and "overidentified". Items are answered according to the statement "How I typically act toward myself in difficult times", and are responded to on a Likert scale of 1 (almost never) and 5 (almost always). The SCS-SF has adequate internal consistency (Cronbach's α=≥0.86 for three different samples) and excellent correlation with the full version (r=≥0.97 for three samples). It is negatively correlated with anxiety (r=–0.49), depression (r=–0.38), and stress (r=–0.52) and is positively correlated with mindfulness (r=0.39).[92] The SCS-SF is scored by calculating the mean of the 12 items (personal communication, Kristen Neff, April 19, 2016).

Five Facet Mindfulness Questionnaire

The Five Facet Mindfulness Questionnaire (FFMQ)-SF is a 24-item version of the original 39-item FFMQ, and has been validated in individuals with depression, anxiety, and fibromyalgia.[93] The FFMQ-SF measures the five factors observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience. Participants respond to each item by selecting the number that is "most generally true" of their experience, on a scale of 1 (never or rarely true) to 5 (very often or always true). Total scores range from 0 to 120, with higher scores indicating greater levels of mindfulness. Total facet scores of the FFMQ-SF are highly correlated with the original version: r=0.89, 0.89, 0.92, 0.96, and 0.95, for observing, describing, acting with awareness, nonjudging, and nonreactivity, respectively.[93] The correlation α-values are all above the

defined criterion of 0.7, and all intercorrelations between facets and with other constructs are virtually the same as those derived from the FFMQ. Specifically, four subscales are negatively correlated with depression (describing, acting with awareness, nonjudging, and nonreactivity), three subscales are negatively correlated with anxiety (acting with awareness, nonjudging, and nonreactivity), and all subscales are positively correlated with psychological flexibility.[93] All facets of the FFMQ-SF are sensitive to change and have moderate–large effect sizes.[93]

Brief Pain Inventory

The Brief Pain Inventory (BPI)-SF is a nine-item self-report questionnaire that measures various aspects of pain and pain interference with daily activities.[94] In the BPI-SF, individuals are queried on pain history, asked to depict pain locations visually on a human-body diagram, and are asked to indicate best, worst, average, and current pain levels according to 11-point Likert scales, ranging from 0 (no pain) to 10 (pain as bad as you can imagine). Participants are also queried about pain medications and treatments and the perceived effectiveness of those medications. Finally, individuals respond to items regarding how pain interferes with seven domains of functioning: general activity, mood, walking ability, normal work, relationships with other people, sleep, and enjoyment of life, according to 11-point scales ranging from 0 (does not interfere) to 10 (completely interferes).

The nine items that comprise the BPI-SF show strong internal consistency (Cronbach's α=0.85 and 0.88 for the intensity and interference scales, respectively) and adequate construct validity (scores on the interference scale correlate with other pain-disability measures), and is sensitive to treatment.[95] The seven-item pain-interference subscale has been recommended for SCI, and item 9C (walking ability) should be changed to "ability to get around", so this was done for the present study.[96] The pain-interference subscale has been used in studies evaluating pain in individuals with SCI.[11,97] It has excellent internal consistency (α>0.9), and is positively associated with pain intensity (r>0.6) and negatively associated with psychological distress (r>0.6).[98]

Pain Catastrophizing Scale

The Pain Catastrophizing Scale (PCS) is a 13-item self-report questionnaire that measures catastrophic thinking in relation to experienced or anticipated pain.[99] Participants are asked to read each item and indicate the extent to which they experience certain thoughts and feelings when experiencing pain by selecting a number from 0 (not at all) to 4 (all the time). Scores range from 0 to 52, with higher scores reflecting higher levels of pain catastrophizing. The PCS yields a total score and three subscale scores assessing rumination (focus on pain sensations), magnification (exaggerating the threat value of pain sensations), and helplessness (perceiving oneself as unable to cope with pain symptoms). The PCS has high internal consistency (total PCS, α=0.87; rumination, α=0.87; magnification, α=0.66; and helplessness, α=0.78).[99] It has been shown to be positively correlated with depression (r=0.26), trait anxiety (r=0.32), negative affectivity (r=0.32), and fear of pain (r=0.8).[99]

Data analysis

Preliminary analysis

The questionnaire data were entered and analyzed using SPSS version 23. Exploratory analysis was conducted to evaluate outliers, missing data, and assumptions of normality (kurtosis and skewness). The Shapiro–Wilk test (n=22) revealed that the assumption of normality was violated at T1 for the AAQ-II (IY), PTGI (WLC), GSES (WLC), at T2 for the AAQ-II (WLC) and HADS-D (WLC), and at T3 for the PTGI (WLC). For participants with pain (n=19 at T1, n=18 at T2, n=7 at T3), the Shapiro–Wilk test revealed that the assumption of normality was violated at T1 for the PCS (WLC) and at T3 for the BPI-4 (WLC). Visual examination of the z-scores on Q–Q plots for these scales revealed violations of normality were not extreme and that there were no outliers. Due to the robust nature of the F-test and the small sample size, transformations were not considered appropriate. Levene's test revealed that variances were equal across conditions at T1 and T2, with the exception of the PCS at T1 and the HADS-A at T2.

Attendance

Of the 11 participants who were randomized to the IY group, 10 completed the yoga intervention (see Figure 1). One participant randomized to this condition was unable to provide a physician's note, and was excluded. Of the 12 participants who were randomized to the WLC group, 8 actually participated in the intervention and all 8 completed it. Four participants withdrew from the study for logistical or non-study-related and illness reasons (eg, moved away, vertigo). Of the eligible participants, 100% who were randomized to the IY group and 66.67% who were randomized to the WLC group completed the study. The mean (± standard deviation) number of yoga classes attended for participants in the IY group was 10±1.83 (of 12 classes). The mean (± standard deviation) number of yoga classes attended for participants

in the WLC group was 9.25±1.83 (of 12 classes). There were no adverse events reported.

Results

Between-group linear mixed-effect growth models

Linear mixed-effect growth models were conducted to evaluate the main effects of group at T2 after controlling for T1 scores. Two models were evaluated for each variable. The first model included fixed factors (intercept, time, condition), and the second model included these same fixed factors and also random intercepts. Consequently, each initial model had four parameters and each final model five parameters, including the residuals. The IY group had significantly lower T2 scores on the HADS-D ($F_{1,18}$=6.1, P<0.05) and significantly higher T2 scores on the SCS-SF ($F_{1,18}$=6.57, P<0.05) for the initial models with fixed factors. For the final models that used one random factor, the identity covariance-matrix structure was used. When random intercepts were added to the model, the model became unstable, as specified by warnings from the statistical program. As a result, the results of the models with random intercepts were not used.

Linear mixed-effect growth models: combined groups

The two groups were combined, and mixed-model analyses were conducted to evaluate differences from preintervention to postintervention. Specifically, T1 data for the IY group and T2 data from the WLC group were combined into one preintervention sample; likewise, T2 data for the IY group and T3 data for the WLC group were combined into one postintervention sample. Once the WLC and IY groups were combined, there was no longer a control group. The Shapiro–Wilk test revealed that the assumption of normality was violated at T1 for the HADS-D.

Linear mixed-effect growth models were conducted to evaluate the main effects of time (T1, T2) for each dependent variable. Two models were evaluated for each variable: the first included fixed factors (intercept, time), and the second included the same fixed factors and also random intercepts. Consequently, each initial model had three parameters and each final model four parameters, including the residuals. The identity covariance-matrix structure was used for the final models that used one random effect. The χ^2 test was used to evaluate the change in $-2LL$ values across the initial (fixed factors) and final (fixed factors and random intercepts) models to determine if the model was improved by adding the random factor and to determine the significance of random effects. Participants who reported having no chronic pain or musculoskeletal pain on the SCS (score of 0) and who reported zero levels of pain on the BPI (n=3) were excluded from the mixed-model analyses conducted for pain and related variables.

The results of the fixed-factor models revealed that postintervention HADS-D scores were significantly lower than at preintervention, ($F_{1,37}$=4.22, P<0.05), with time predicting HADS-D scores (b=–1.9, t_{37}=–2.06; P<0.05). There was a trend for FFMQ-SF – total scores ($F_{1,37}$=2.98, P=0.09) and FFMQ-SF – observing scores ($F_{1,37}$=3.65, P=0.06) to improve from preintervention to postintervention. When random intercepts were added to the models, the models improved and random intercepts varied for all variables, except the observing and acting with awareness subscales of the FFMQ-SF and the magnification subscale of the PCS (see Table 3).

The mixed (fixed and random factors) models revealed that postintervention scores were significantly lower than preintervention scores for the HADS-D and significantly

Table 3 Variance across intercepts and change in $-2LL$ for the combined groups

Measure	Var(U_{0j})	$\Delta-2LL$, χ^2
AAQ-II	72.16*	10.67*
HADS-A	24.76*	28.26*
HADS-D	6.7*	7.72*
GSES	10.25*	12.1*
PTGI-SF	127.98*	26.78*
CD-RISC-10	28.21*	8.12*
SCS-SF	0.36*	10.26*
FFMQ-SF – total	84.68*	9.57*
FFMQ-SF – describing	16.93*	14.59*
FFMQ-SF – observing	1.9	0.93
FFMQ-SF – acting with awareness	4.4	1.95
FFMQ-SF – nonreactivity	9.87*	10.25*
FFMQ-SF – nonjudging	14.65*	12.57*
BPI-SF – worst pain	4.79*	8.15*
BPI-SF – least pain	4.52*	23.32*
BPI-SF – average pain	3.67*	16.48*
BPI-SF – pain right now	6.42*	17.15*
BPI-SF – pain interference	316.4*	12.42*
PCS – total	146.02*	9.88*
PCS – magnification	6.32	3.58
PCS – helplessness	33.88*	12.79*
PCS – rumination	17.62*	13.32*

Note: *P<0.05.

Abbreviations: AAQ-II, Acceptance and Action Questionnaire; HADS-A, Hospital Anxiety and Depression Scale – anxiety; HADS-D, HADS – depression; GSES, General Self-Efficacy Scale; PTGI-SF, Posttraumatic Growth Inventory – short form; CD-RISC-10, ten-item Connor–Davidson Resilience Scale; SCS-SF, Self Compassion Scale – short form; FFMQ-SF, Five Facet Mindfulness Questionnaire – short form; BPI-SF, Brief Pain Inventory – short form; PCS, Pain Catastrophizing Scale.

higher than preintervention scores for the SCS-SF, FFMQ-SF – total, FFMQ-SF – observing and FFMQ-SF – nonreactivity (Table 4). Time was a significant predictor for each variable. Although the model with random intercepts did not improve for the observing subscale of the FFMQ-SF, the effect of time for this subscale was significant for the fixed-factor model, and so the results from the mixed-effect model were considered appropriate for interpretation. Scores for all variables for the combined group are presented in Table 5.

Discussion

The results of this RCT indicate that self-reported symptoms of depression improved and self-compassion increased in individuals with SCI who participated in a specialized 6-week yoga intervention compared to a WLC. The results also suggest that the yoga intervention increased levels of mindfulness broadly, and also for specific components of mindfulness, such as the capacity to observe and not react to internal experience. These results do not confirm hypothesis one, but partially confirm hypotheses two and three. The yoga program was considered safe, with no reported adverse effects. All participants who began the yoga intervention completed it. Some attrition occurred at the time of randomization, with mostly logistical reasons of not being able to attend the sessions. This contrasts with our previous study, in which there was a high rate of attrition.[60]

The lower scores for depressive symptoms at postintervention for the IY group were consistent with improvements from other yoga trials evaluating mood for limited-mobility populations and with previously documented evidence regarding the efficacy of yoga for clinical depression, according to the Oxford Centre for Evidence-Based Medicine method of appropriateness.[45] Depression was found to improve clinically in individuals with poststroke hemiparesis after participation in a 10-week yoga trial compared to no treatment controls.[100] For participants with osteoarthritis, participation in a twice-weekly 8-week, "sit 'n' fit" yoga

Table 4 Results from the mixed-model analysis (n=22)

Measure	*F*	*t*	*df*	*b*
HADS-D	6.62*	–2.57*	1, 14.83	–1.37
SCS-SF	4.49*	2.12*	1, 16.6	0.27
FFMQ-SF – total	5.42*	2.33*	1, 16.79	4.87
FFMQ-SF – observing	5.06*	2.25*	1, 19.82	1.88
FFMQ-SF – nonreactivity	4.92*	2.22*	1, 16.53	1.5

Note: *$P<0.05$
Abbreviations: HADS-D, Hospital Anxiety and Depression Scale – depression; SCS-SF, Self-Compassion Scale – short form; FFMQ-SF, Five Facet Mindfulness Questionnaire – short form.

Table 5 Mean (SD) values for psychological, mindfulness, and pain variables pre- (n=22) and postintervention (n=17) for all participants

Measure	Preintervention	Postintervention	*P*-value
AAQ-II	17.59 (10)	14.24 (6.09)	0.226
HADS-A	6.64 (5.35)	5.53 (3.37)	0.795
HADS-D	4.95 (3.18)	3.06 (2.36)	0.021*
GSES	34.09 (3.64)	34.88 (3.48)	0.551
PTGI-SF	31.45 (12.62)	33.76 (12.15)	0.462
CD-RISC-10	30.73 (6.74)	32.59 (5.59)	0.568
SCS-SF	3.36 (0.73)	3.71 (0.66)	0.049*
FFMQ-SF – total	82.27 (11.43)	88.41 (10.43)	0.033*
FFMQ-SF – describing	17.82 (4.81)	19.24 (3.95)	0.551
FFMQ-SF – observing	14.68 (3.29)	16.47 (2.29)	0.036*
FFMQ-SF – acting with awareness	17.82 (3.79)	18.65 (3.6)	0.497
FFMQ-SF – nonreactivity	15.5 (3.91)	17.35 (3.33)	0.041*
FFMQ-SF – nonjudging	16.45 (4.66)	16.71 (3.53)	0.784
BPI-SF – worst pain	5.79 (2.37)	6.14 (2.77)	0.845
BPI-SF – least pain	2.79 (2.37)	3.07 (2.13)	0.528
BPI-SF – average pain	5.11 (2.13)	5.14 (2.03)	0.196
BPI-SF – pain right now	3.89 (2.85)	3.79 (2.39)	0.107
BPI-SF – pain interference	30.42 (20.54)	28.86 (17.06)	0.275
PCS – total	18.95 (14.97)	14.64 (8.89)	0.328
PCS – magnification	3.36 (3.62)	2.79 (2.61)	0.522
PCS – helplessness	9 (6.85)	6.57 (4.47)	0.191
PCS – rumination	6.32 (5.04)	5.29 (3.36)	0.461

Notes: *$P<0.05$. For pain variables (BPI-SF and PCS), only participants with pain were included in the analysis (preintervention, n=19; postintervention, n=14).
Abbreviations: AAQ-II, Acceptance and Action Questionnaire; HADS-A: Hospital Anxiety and Depression Scale – anxiety; HADS-D, HADS – depression; GSES, General Self-Efficacy Scale; PTGI-SF, Posttraumatic Growth Inventory – short form; CD-RISC-10, ten-item Connor–Davidson Resilience Scale; SCS-SF, Self Compassion Scale – short form; FFMQ-SF, Five Facet Mindfulness Questionnaire – short form; BPI-SF, Brief Pain Inventory – short form; PCS, Pain Catastrophizing Scale.

program resulted in improvements in depression symptoms compared to an attention control group.[101] A pilot trial evaluating the utility of yoga plus intensive physical therapy for individuals with multiple sclerosis found improvements in depressive symptoms when using the same scale as the present study (HADS-D).[102] In addition, a pilot RCT evaluating the impact of an innovative yoga program consisting of classical breath exercises, relaxation, and meditation for individuals with Guillain–Barré syndrome found improvements in depressive symptoms for individuals randomized to the yoga group compared to individuals receiving standard rehabilitation program, as measured by the HADS-D.[103] The classification of SCI in this present study was broad and included demyelinating diseases of the central nervous system, and so the results of similar studies emphasizing the breath-exercise and meditative components of a yoga program indicate that these accessible and more subtle elements of yoga may be useful and applicable for individuals who have limited range of motion or who have had trauma to the central nervous system.

The increased levels of self-compassion postintervention indicate that individuals in the yoga condition experienced a change in psychological orientation to pain and suffering compared to the WLC group. The present finding that self-compassion increased significantly from preintervention to postintervention parallels the results from other yoga-research trials involving chronic health populations. Individuals living with an implantable cardioverter defibrillator who were randomized to a once weekly 8-week yoga intervention demonstrated increased self-compassion at the end of the yoga program compared to a treatment-as-usual group.[57] Improvements in self-compassion were also observed from preintervention to postintervention in a pilot research trial evaluating an 8-week yoga intervention for individuals with chronic complex disease and disability.[52] Notably, self-compassion was found to mediate changes in anxiety from preintervention to postintervention, speaking to the mechanisms of yoga practice and philosophy didactics on psychological experience. The authors concluded that self-compassion may enable individuals to contact distressing inner experience without ascribing evaluative or judgmental meaning, to bypass ruminative tendencies, and to select healthful and agential actions to create positive change.[52]

Corroborating the increases in self-compassion were changes in levels of mindfulness, which is an overlapping third-wave construct. Total levels of mindfulness and the subscales of observing and nonreactivity all increased from preintervention to postintervention when the participants were evaluated as one cohort. These findings parallel results from trials that evaluated mindfulness in the context of a yoga intervention for individuals with chronic pain and limited mobility. Specifically, an 8-week pilot yoga program for individuals with fibromyalgia resulted in improvements in the total scale and in the describing and nonreactivity to inner experience subscales of the FFMQ.[51] Improvements in two subscales of the FFMQ – nonjudging of inner experience and acting with awareness – were observed for cancer survivors who participated in a 7-week yoga intervention.[104] The fact that different subscales demonstrated improvements across the studies may be attributable to the differences in the intervention's philosophical focus, specific attentional or meditative training, variations in the teaching style, or to the specific health populations. In addition, there were also qualitative reports of increased present-mindedness (being in the moment, letting go, new way of being in old experience, increased awareness of body, increased concentration) for individuals with SCI who participated in an 8-week yoga program.[60] Taken together, these studies indicate that yoga programs that are comprehensive in nature and that include philosophical concepts that bridge the two disciplines (eg, witness consciousness, one pointed concentration, nonjudgment, openness) have demonstrated increased levels of mindfulness in individuals with health-related impacts or disability.

There were no demonstrated improvements in pain intensity, pain interference, or pain catastrophizing. It may be that the questionnaire used to measure pain (BPI) was limited in scope, as it used gross numeric rating scales for worst, least, average, and present pain levels, and did not query for pain quality or type. The use of more specific pain-measurement tools, such as the McGill Pain Questionnaire, may provide more detailed information about the type (eg, neuropathic, musculoskeletal) and quality (eg, affective, cognitive, evaluative) of pain and whether various types of pain respond differently to yoga practice. Similarly, there were no improvements in other psychological constructs, such as psychological flexibility, anxiety, self-efficacy, resilience, or posttraumatic growth. Scores on psychological flexibility, self-efficacy, resilience, and posttraumatic growth were all high at the beginning of the study, which may have served as a ceiling effect, resulting in limited room for improvement. The lack of a signification reduction in anxiety differs from an RCT evaluating yoga for individuals with chronic back pain compared to an exercise control group[105] and from a previous pilot trial using a similar yoga-program manual.[52] One possible explanation for this discrepancy is the components of

the yoga program: active arm work and philosophy didactics may have provided an uplifting quality, rather than a calming or anxiolytic quality.

Given the breadth and variety of yoga interventions that are used in yoga research, it is imperative to document properly the specific components of a yoga program and delineate how interventions are tailored for various populations.[72,106] The present study used an integrated yoga intervention that incorporated many "limbs" or aspects of yoga, including breathing practices, physical postures, yoga philosophy, mindfulness, and meditation/relaxation techniques. Although such a comprehensive program is not a new format in the yoga literature,[72] this combination of limbs has not been applied to an SCI population and was innovative in the consideration and application of yoga philosophical concepts. This intervention was designed in accordance with the teaching philosophy of IY, in terms of progression of instruction with the skill development of the students/participants, in modeling the ethical principles through the style of teaching, the use of therapeutic variations of classical poses, and of the selection of practices that are considered within this yogic lineage both to calm the nervous system (eg, breathing and meditation), to promote vitality, and to lift depressive or "heavy" states of mind.[65] The authors have provided a table of philosophical concepts in order to document which yogic theories from traditional texts and the Iyengar lineage were considered appropriate for this population and to assist with replicability.

Limitations

The present study was limited by its small sample size, which increased the possibility of type 2 errors, and by the exclusive use of self-report measures. The evaluation of multiple measures also introduced the possibility of a type 1 error, and so results should be replicated with a larger-scale RCT. Study methodology using a WLC design is limited by the possibility that participants in the WLC group may change their behavior in the waiting period. The authors instructed the participants to refrain from practicing yoga in that time, to prevent a possible confound. As well, there was the possibility of an expectancy effect for WLC participants, which should be considered when interpreting the results of the combined-group analysis, and in particular the findings that emerged in this analysis only (eg, increases in mindfulness). Although there was one member of the research team present at all assessment points, there were additional research assistants at each time point, which may have introduced variability in the assessment process.

In addition, there were a higher number of individuals of Caucasian heritage in the WLC group, and this discrepancy should be considered when interpreting the results. Although this pilot RCT tailored the yoga intervention to individuals with SCI who had limited mobility and instability of the musculoskeletal system, it was not specialized to the degree of injury and thus did not differentiate between individuals with varying levels of injury. Future studies should specialize yoga programs to a greater extent, especially for individuals with tetraplegia or complete SCI who may need greater one-on-one care and modification of āsanas, due to the unique presentation of each SCI. The use of props was limited to IY blankets for spinal and postural support, and greater precision and effect of āsana practice could be attained with the use of other traditional yoga props, such as straps and bolsters.

Future research

The emerging field of yoga research for individuals with severe and impairing disability would benefit from larger trials to explore further the impact of yoga interventions on psychological, pain-related, functional, and mindfulness constructs. Given that levels of mindfulness and self-compassion increased in this study, and have been shown to be mediating variables of improvements in psychological experience in other yoga-research trials, future research should evaluate the mediating role of these constructs for individuals with SCI. It has been proposed that mindfulness may provide therapeutic gains by increasing compassion and psychological flexibility and by decreasing the propensity for rumination,[107] and so modeling of the relationships of these variables in the context of a yoga intervention is warranted.

In order to create meaningful yoga interventions for individuals with tetraplegia, it is recommended that larger trials use a multiwave design rather than increased class sizes, so that individualized care is possible. Researchers employing an RCT design may consider stratifying participants by injury level, degree of completeness, or mobility characteristics, which may require multisite involvement, due to recruitment limitations. It may also be beneficial to have a high teacher:student ratio to ensure that participants maximize in obtaining benefits from the degree of movement that is accessible for each student. Previous research has documented that participation in an IY-intervention resulted in reduced pain-medication consumption for individuals with chronic low-back pain,[108] and so evaluation of the impact of yoga on pain-medication consumption for individuals with SCI may provide important information regarding alternate pain-management strategies. In

communities where public and accessible transport is not possible, such as rural and remote settings, the use of electronic resources or videoconferencing for service provision may be useful and increase access for individuals who encounter physical limitations to attending institutionally based yoga interventions. Finally, interventions should be evaluated at follow-up intervals using a longitudinal research design to determine the lasting effect of yoga on psychological experience. It is important to conduct yoga research for this population, as yoga represents a mind–body intervention that can simultaneously address physical and mental health impacts and thus improve multiple facets of patient well-being. Yoga is a relatively low-cost therapeutic intervention that once learned, can be practiced safely and independently, thereby empowering patients and partially reducing dependence on care providers.

Conclusion

The results of this pilot RCT revealed improvements in depressive symptoms and self-compassion for individuals randomized to IY compared to a WLC group. The results also suggest that a yoga program may result in increases in mindfulness from preintervention to postintervention, with an increased capacity to observe and not react to immediate physical and emotional experience. Yoga is a safe and supportive mind–body practice that may simultaneously attenuate some of the negative psychological impacts of SCI, while also bolstering inner resources. Therapies, such as yoga, that incorporate mindfulness concepts, such as acceptance and openness, and that focus on positive and adaptive coping may offer protection from some of the devastating and life-altering consequences of SCI, and should be integrated in tertiary care settings offering rehabilitative services.

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Disclosure

The authors report no conflicts of interest in this work.

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Section 3: Qualitative Data Results

In this Section, I present the results of the qualitative interviews conducted with the 18 participants. These data were not included in the submitted manuscript above, due to space limitations. They are included here to provide a more in depth understanding of the participant's experience in the yoga program and to provide meaningful information to supplement the quantitative data. I first provide information on the procedure, then provide information on the form of analysis used and finally, provide the results, according to the questions asked in the semi-structured interviews.

Procedure.

Participants were queried on their expectations for the yoga program prior to participation and on their experiences of the yoga program post-participation (Appendix C; Qualitative Questions). Figure 3 illustrates the temporal relationship between the qualitative and quantitative data collection.

Pre-Program Interview.

Prior to participating in the yoga program, participants were queried on their expectations for the yoga program. A brief form on expectations was administered with the quantitative questions at T1 for the IY group and at T2 for the WLC group. The participants hand wrote their expectations for participation on the form, which took approximately 3-5 minutes. A member of the research team hand wrote the expectations for participants who had difficulty with fine motor control.

Post-Program Interview.

Interviews entailing open-ended questions were conducted after participants had completed the assigned yoga program to capture any meaningful changes that occurred and that might not have been obtained by the standardized questionnaires. Open ended questions were asked about experiences with the yoga program; physical, emotional or social gains or changes attributable to the yoga program, perceptions of ones' body; changes in daily life since participation in the yoga program; as well as perceived barriers or any negative effects (Anderzen-Carlsson et al., 2014; Cramer, Lauche, Haller, et al., 2013; Garrett et al., 2011). The qualitative interviews were conducted by research team members (Kathryn Curtis, Candice Stoliker, Claire Wicks, Meghan Ferguson). The post-program interviews were audio-recorded, and took approximately 20-30 minutes to complete. The interviews occurred in the Therapeutic Recreation Department main activity room, with the room partitioned for privacy, the room where the yoga program occurred and in adjacent rooms. A research assistant (Candice Stoliker) transcribed the audio files. Similar to the quantitative date, the qualitative data was stored on the TRI Research Server and hard copy materials has been stored in a locked cabinet at LC. The audio files were encrypted and stored on a secure computer/server.

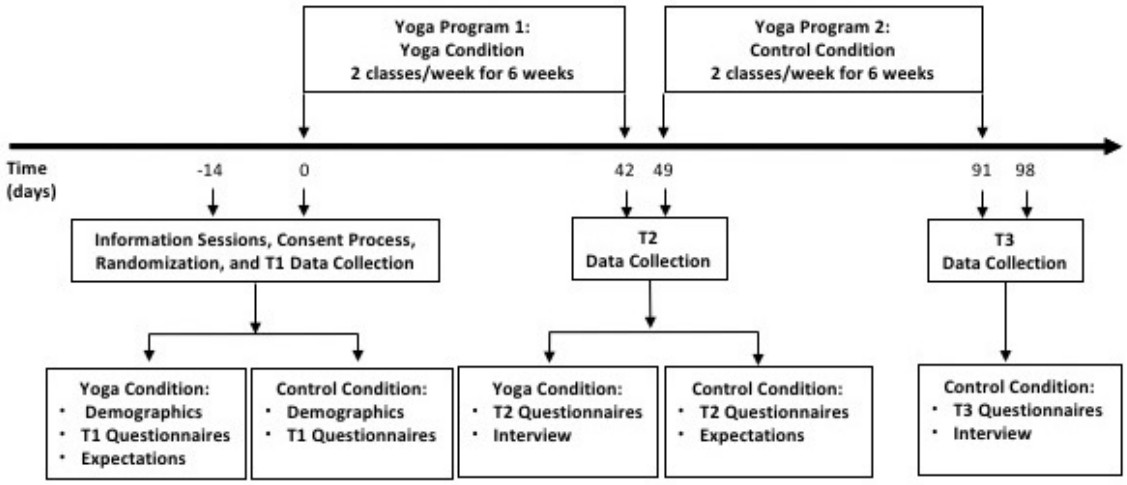

Figure 3. Temporal Sequence of the Yoga Interventions and Data Collection for Both Groups, Including Qualitative Data Collection

Results.

Expectations.

Prior to participating in the yoga intervention, participants (N = 18) reported expecting changes according to six themes: (a) *Meditation/Breathing/Relaxation* (n = 11; e.g., knowledge of breathing/meditation, better breathing, decreased stress), (b) *Physical Poses* (n = 12; e.g., exercise, stretching, build a routine, safe movement, alternative and accessible exercise, (c) *Improved Physical Function and Health* (n = 12; e.g., increased flexibility, strength, mobility, decrease in muscle spasms, healthy lifestyle, weight loss, (d) *Decreased Pain* (n = 6; e.g., reduced pain, pain management strategies), (e) *Learn About Yoga/New Techniques* (n = 8; e.g., increased knowledge of yoga), and (f) *No Expectations* (n = 2).

Experiences.

The main themes for all questions are presented in Table 6 and a full description of themes and sub-themes follow in the text.

Table 6

Qualitative Data Main Themes from Post-Yoga Program Interviews (n = 18)

Questions	Main Themes
1./2. Experiences and Benefits	(a) Mental/Emotional Benefits (b) Physical Improvements (c) Social (d) Overall Helpfulness

	(e) Reason for Participating/Expectation
3. Negative Effects	(a) No Negative Effects (b) Logistics (c) Content of Class (d) Challenges in Practice (Frustration with Limits; Difficulties Focusing the Mind; Initial Increase of Pain or Strain)
4. Changes in Handling Challenges	(a) Increased Capacity to Cope with Stress and Emotions/Shift in Priority (b) Using Breathing as a Tool (c) Ability to Face Physical Challenges (d) Self as Priority (e) Embodying Mindfulness Principles (f) No Changes
5. Changes in Perception of Body	(a) Increased Physical Capabilities (b) Increased Awareness (c) Overcoming Limits (d) Decreased Pain and Ability to Use Yoga to Manage Pain (e) Yoga as Activity (f) No Shift in Perspective
6. Changes in Sense of Self	(a) Commitment to Self (b) Connection to the Present (c) Shift in Perspective (d) No Shift
7. Changes in Perspective of the Future	(a) Yoga as a Tool for Health (b) Continue with Yoga/Movement (c) Resilience (d) No Change
8. Changes in Daily Life	(a) Practicing Yoga (b) Using Breathing/Relaxation/Meditation (c) Increased Quality of Life (d) No Change
9. Changes in Purpose in Life	(a) Self as Priority (b) No Change
10. Additional Feedback	(a) Appreciation of Yoga (b) Recommendation to Have Yoga as Part of a Rehabilitation Program

(c) Specialization of Yoga
(d) Practice Materials
(e) No Further Comment

Responses to questions one ("What were your experiences of the yoga program?") and two ("Did you notice any benefits from the yoga program and if so, what were they?") were similar and so they were collapsed. If participants included information about challenges or aspects about the yoga program that were unfavourable, this information was moved to question three ("Did you notice any negative effects of the yoga program and if so, what were they?"). If participants provided information that was more relevant to another question, that information was moved to the appropriate section. Taken together, participants (N =18) responses were classified according to five main themes about the positive aspects of the yoga intervention: (a) *Mental/Emotional Benefits,* (b) *Physical Improvements,* (c) *Social,* (d) *Overall Helpfulness,* and (e) *Reason for Participating/Expectation*. Figure 4. Presents themes and sub-themes for these collapsed questions.

Figure 4. Themes and Sub-themes for Qualitative Questions on Experiences and Benefits of the Yoga Program

The theme of *Mental/emotional Benefits* (n = 15) was comprised of four sub-themes: (a) *Peaceful/Relaxation/Calm* (n = 14; e.g., feeling of relaxation, calm, or a change in the quality of usual self)**;** (b) *Meditations/Mindful Awareness* (n = 12; e.g., enjoyed how the teacher instructed meditation, enjoyed the quiet space, letting go, body scan was adventurous (focus on specific body parts, empty your mind), centre awareness/heart centred, self-awareness, paying attention, mindfulness, tuning into surroundings, present moment, tune into self, block everything out, decreased chatter and distraction, slow down, mind-body connection, benefits of "right now"); (c) *Breathing* (n = 8; e.g., improved breathing, awareness of breathing); (d) *Improved*

Psychological State (n = 5; e.g., happier, positive outlook, feel better, good for the mind, less black, less worried about stiffness). A quote from Participant #104 highlights the theme of *Improved Psychological State*:

> I think it's all part of feeling better, so when you're feeling better, your emotions are more positive. Things don't seem so black or as negative…I think with a lot of people who have an injury (tetraplegia or paraplegia), you sometimes they say "no pain, no gain", but sometimes the pain is not worth the gain. But this is a gentle way of getting more and you can do it gently and see benefits.

The theme of Physical Improvement (n = 18) was comprised of six sub-themes: (a) *Improved Physical Function: Strength/Mobility/Flexibility/Stamina*, (n = 16; e.g., increase in circulation, stretching, looser muscles (back and shoulder), relieved tension, increased mobility, increased flexibility, increased strength, increased muscle control (muscles of torso), less stiff, increased sitting tolerance, increased stamina, improved sleep); (b) *Decreased Pain,* (n = 10; e.g., reduced pain (shoulders, hips, arms, neck, back), decreased pain resulted in calm/relax/decreased stress and ability to do more (cooking, art, and improved health), can achieve more if can sit for longer, reduced upper body strain from overuse); (c) *Improved Posture,* (n = 10; e.g., sitting up straight, aligned spine, remedied slouching to one side, elongated neck, spine popped, decreased head protruding forward, opened body); (d) *Increased Awareness of the Physical Body,* (n = 7; e.g., attunement to sensations, awareness of pain, tension, separating body parts (lower and upper torso); (e) *Enjoyed Physical Postures and Refined Movements*, (n = 11; e.g., enjoyed stretching, satisfying, liked specific poses (*ūrdhva hastāsana*, neck stretches, twist, *garuḍāsana*), refinement and targeting of unique movements

(shoulders and chest, good to twist from core not neck), move parts of body can't feel, recruit muscles that help with movements, refreshing quality, new control of muscles); and (f) *Specialization of Practice with Modification/Props,* (n = 8; e.g., props were helpful to assist with posture, felt taller with props, will use props in the future, props need to be very specialized, modifications were helpful to reduce strain (neck/shoulders) and to mitigate balance issues), dosing of effort (was careful not to overdo), ability to do more than thought, overcoming limits to quadriplegics, appropriate level of difficulty, easy on joints). Participant #104 described some of the physical changes she experienced:

> I've noted an improvement in my overall strength and my range of motion. My shoulder range, the way they move, my arms. There's some tightening that's gone on in just six weeks. One of the things quadriplegics do is that they kind of stabilize with their upper body in order to do tasks and so what happens is the torso with hips – it all becomes one piece. The body, the trunk of the body, becomes one piece, and so what I found is this twisting has given me range and separation from the waist up and the hips down which is wonderful. Definitely, the oxygenation of the body, which helps you cope with stress and manage pain better. Um, the actual increased range of motion from doing the movements, um, upper body strength, um, and posture was improved. I'm consciously now, am more aware of where my shoulders are and my neck are more, so ya, tightening up of the body.

The improvement in posture was also noted by participants #103 and #105:

> I think the greatest benefit that I had here was my posture, I feel like I sit up better and it alleviates the pain in my back…and knowing different stretches to do to release some pressure was really good (#103).
>
> I realized more the alignment of the spine and the stretching and the air flow of my body becoming more aware of that. Um you know the possibilities of being able to turn more the range became stronger and the muscles became stronger um I was able to do more than I thought I was capable of (#105).

The theme of *Social* (n = 12) was divided in three sub-themes: (a) *Enjoyed Social Element* (n = 10; e.g., liked meeting teachers and people); *Group Component was Motivating,* (n = 3; e.g., encouraging and helped with accountability); and (c) *More Expressive* (n = 1; e.g., talk more freely). The theme of *Overall Helpfulness* (n = 17) was comprised of four sub-themes: (a) *Positive/Beneficial* (n = 14; e.g., enjoyed it, looked forward to it, accessible, safe, liked structure of the classes, it was well thought out, like holistic approach, was effective, liked atmosphere); (b) *Learning* (n = 6; e.g., gained knowledge of yoga, learned new movements); (c) *Instructors* (n = 5; e.g., pleasant, knowledgeable, soothing); and (d) *New techniques* (n = 7; e.g., yoga for acute pain management and interference, yoga as warm up for other activities, yoga to quiet the mind, yoga to help with pain and stress, techniques are beneficial, skills are portable).

Participants #101 and #108 speak to the quality of the instructors:

> I thought the instructor was excellent. It was great to learn some of the yoga terminology and the ideas and philosophies behind what we learned. She was very attentive to all the participants and did a good job of adapting the practice to the individuals in the group (#101).

> I think it was taught by someone who was very grounded, very open-minded about people with disabilities as well, physical disabilities, so that makes a huge difference when you have someone so lovely and she is very knowledgeable about yoga after having practiced it for so long, I think 20 years, it's just positive, it's just all around positive (#108).

In terms of the theme of *Reason to Participate/Expectations* (n = 14), participants reported five sub-themes: (a) *Learn/Curious About (Chair) Yoga* (n = 4; e.g., learn about yoga, be involved with yoga); (b) *Improve Physical Health* (n = 8; e.g., reduce pain, help with back issues, helped in the past); (c) *Take Care of Self* (n = 7; e.g., feel better, relax, self-awareness/centring, good for me); (d) *Try Something New/Sounded Interesting,* (n = 9); and (e) *Exercise or Daily Activity* (n = 6).

In response to question three ("Did you notice any negative effects of the yoga program and if so, what were they?"), participants reported four themes: (a) *No Negative Effects* (n = 8); (b) *Logistics* (n = 5; e.g., time of class, starting late, time frame too short); (c) *Content of Class* (n = 3; e.g., would like more movement, too many repetition of poses); and (d) *Challenges in Practice* (n = 8), which is further divided into three sub-themes. These sub-themes for Challenges in Practice include: *Frustration with Limits* (n = 4; e.g., didn't like tasks couldn't do, frustration that couldn't do everything, challenging to practice if body was tired, still experienced muscle spasms); *Difficulties Focusing the Mind* (n = 2; e.g., meditation was hard to follow, hard to focus mind if in pain); and *Initial Increase of Pain or Strain* (n = 4; e.g., pain in arm and chest, due to new movement, difficulty maintain upright posture). The themes Content of Class and Challenges in Practice are clear in a quote from participant #102:

> I don't really like the meditation part of it. I couldn't follow the instruction. That I thought was a little bit too much, in fact I wanted to do more exercise physically like less of the mental thing, it was hard to be in that environment and completely let go of everything, I was not in the right state of mind to do it. And not doing, it was a work day there was so much going on in my head I couldn't really concentrate.

The theme of Initial Increase of Pain or Strain was evident in a quote from participant #205:

> I found that um, especially when I first started getting in that upright posture and maintaining it for periods it was a strain and I could feel discomfort in places and that was about it.

In response to question four ("Did you notice any changes about how you handle challenges over the course of the yoga program, and if so, how?") participants reported six themes: (a) *Increased Capacity to Cope with Stress and Emotions/Shift in Priority* (n = 5; e.g., can deal with things better because more relaxed, new way of handling stressful situations, used to take them to heart, more adept at resolving challenges, lower stress, ability to prioritize differently, perspective about what's important, uses relaxation to clear mind, increase feelings of calm, delegates tasks); (b) *Using Breathing as a Tool* (n = 6; e.g., uses breathing to cope with stress, emotions, or racing thoughts, focus on breathing to return to the present moment or remain calm); (c) *Ability to Face Physical Challenges* (n = 4; e.g., can face new physical challenges, increased ability to use pain management strategies, portable physical postures as a tool, ability to notice pain, relaxing muscles purposely, centers the body, doing yoga daily to

help with stiffness, uses relaxation to regulate heart rate and breathing); (d) *Self as Priority* (n = 6; e.g., can put myself first, others can wait, more confident as posture opened and improved, feeling better about self, doing something for myself, adjusting mental expectation of self that are realistic, personal growth); (e) *Embodying Mindfulness Principles (open, non-attachment, less reactivity)* (n = 6; e.g., more open minded and accepting and finding a solution and moving forward, mental part where you let go, not needing to solve problems, calmer, less reactive, more open in expressing self, uses mindfulness to manage emotions); (f) *No Changes* (n = 5). The theme of Increased Capacity to Cope with Stress and Emotions is evident in a quote from participant #201:

> Awareness was something that was definitely new – a new muscle I never used before, becoming aware and using the guided relaxation. The guided relaxation… was something that was very helpful because I would focus on those areas (of the body) and…when I would focus on it, the pain would get relieved but the fact you do notice it is something that's very useful. The relaxation was very good because it would clear your mind from things and regulate the breathing and heart rate and all the tension… I would do the relaxation…and regulate the breathing and relax and everything, it feels very refreshing that is something that I would like – usually before a test I will be cramming and sometimes that doesn't help – it is a handy tool, to have the relaxation just before a test and you go in just refreshed like you just woke up from a power nap. The first two sessions I didn't really feel, and I was skeptical of the Zen, the breathing, forget everything you know I never before had that luxury to let everything go but I would try after the third sessions, especially at the end…the guided relaxation and I would leave very different, very

> relaxed, calm very relaxed – a big relief was off my shoulders. You know you could tell me some bad news and it would be okay, no sourness in my body and not just for tests or before a race it could be coming home after a hard day, you can melt that away and that is a useful tool.
>
> Participant #208 stated, "going back to the relaxation, I believe that I can deal with issues better because I can relax on occasion – maybe take 10 minutes before I react to something."
>
> Participant #108 also stated that she dealt with challenges differently:
>
> I think in retrospect overall it helps calm you instead of reacting immediately, trying to take a deep breath. I think definitely this has really helped to meet and resolve challenges a lot easier and a lot more efficiently.

In response to question five ("Since you participated in the yoga program, did your perceptions of your body change, and if so, how?") participants reported six themes: (a) *Increased Physical Capabilities* (n = 13; e.g., body parts were more open (shoulder, chest), better posture, looser in areas that are usually tight, sitting taller, increased strength, increased range of motion, increased flexibility, increased agility, length of spine, space between vertebrae, improved eating and breathing); (b) *Increased Awareness* (n = 10; e.g., increased awareness of body parts, new gratitude for parts with mobility, shift from focusing on paralyzed body parts to ones with mobility, increased mindful/thoughtful movement, paying attention to body's alignment and breathing, new sensations, increased awareness of: posture, sides of body, position of head, body's limits, pain, cracking, and tension, and the need to do more for the body); (c) *Overcoming Limits* (n = 6; e.g., can now do specific poses couldn't do before, pushed self to

walk farther, unpleasantness turns to pleasantness, can stretch more than thought, improved drastically in a short time); (d) *Decreased Pain and Ability to Use Yoga to Manage Pain* (n = 4; e.g., reduced pain, using yoga to manage pain, new response to pain); (e) *Yoga as Activity* (n = 2; e.g., desires to explore tailored exercise/yoga, using yoga to prepare for other activities); and (f) *No Shift in Perspective* (n =2).

The shift from focusing on paralyzed body parts to parts with mobility is evident in a quote from participant #201:

> The awareness was a big part of it. The parts that the parts of the body I would take for granted … being able to focus my attention on certain parts of my body and you know just because I noticed that I have no pressure sores, (which; sic) are a very big problem in wheelchair users, that becoming aware that is the – if I have pain in my arms I'll know – knowing myself and all of my body from my head to my toes – it helped me with that. It made me become other than just looking at the legs, the parts that I don't feel anymore, if anything the parts that I do feel I neglect – my chest, arms neck head – it did make it remind me to not neglect those parts because I do feel them it is good to stretch and maintain them. It did help myself to just focus on my while body the parts that need the help and the parts that don't….

The theme of Overcoming Limits was evident in quotes from participant #207 and #106:

> I think so I think I discovered I can stretch more than I thought I could. Ah well I just mean even without being able to move my fingers and really stretch it out.

> There are some calisthenics exercises I've always done at home. But I found in this class um I pushed myself to stretch my arms father out and up than I would have ordinarily in my past exercises and then I was able to (#207).
>
> Yes, usually I walk with my neighbour and she actually often asks me how are you feeling, do you want to turn around? Now I am like okay, let's go further. I think (of) what Gitte was saying - the things that we do not like doing more. That came in to mind so I actually pushed myself to go further…to extend, the unpleasantness turns into pleasantness (#106)

In response to question six ("Did you experience any shifts in how you think about, understand or experience your sense of self throughout the yoga program, and if so, what were they?"), participants reported four themes: (a) *Commitment to Self* (n = 5; e.g., commitment felt good, taking time for myself, prioritizing self, taking care of self, motivated to do more, self-care and increased energy); (b) *Connection to the Present* (n = 8; e.g., living in the moment, present, grounded, awareness of racing thoughts/chatter, more peaceful, finding myself, "going to myself," more tolerant and accepting, meditation can help the body slow down, mind is relaxed, increased awareness); (c) *Shift in Perspective* (n = 7; e.g., appreciation of not having certain health problems (pressure sores), appreciation of nature, increased ability to deal with things better, new possibilities, less focused on winning, more focused on learning and growing, more awareness of limits of body, more positive, happier); and (d) *No Shift* (n = 6). The theme of a shift in sense of self in relation to the present moment is present in quotes from participant #204 and #106:

> Sense of self I think comes to sense of um, um, taking the opportunity and realizing the possibilities that are out there… It shifts for the better …Ya, the sense of self is realizing this is possible – this activity (yoga) that I am being taught it is something that is possible that I can apply in my life within all the other activities that I am doing that is a beneficial tool. While I am applying it with everything else that is where the value comes through (#204).

In response to question seven ("Since you participated in the yoga program, have there been any changes in your perspective about your future?"), participants reported four themes: (a) *Yoga as a Tool for Health* (n = 8; e.g., use yoga as a maintenance and care method and to prevent health problems (arthritis, diabetes), yoga to manage stress related to health, use yoga to cope with surgery, more commitment to pain reduction, more awareness of long term effects of aging with SCI, yoga to heal, yoga to increase sitting tolerance); (b) *Continue with Yoga/Movement* (n = 9; e.g., incorporate yoga into life, learn more about yoga, explore, other kinds of movement possibilities, yoga as a warm up activity, yoga as exercise, use props); (c) *Resilience* (n = 7; e.g., Less fear (about sitting and stiffness), more optimistic, can approach future with calmer perspective, gathering attention, focusing on the moment, has a force-field to decrease mind's chatter, manage stress, open-minded, slow down, prioritize self, find a way to decrease chaos and business, positive perspective); and (d) *No Change* (n = 5). Participant #108 provided the following quote about her perspective on her future:

> Maybe I can approach it with a calmer perspective. I have two more surgeries in the future, you are just trying to take it one day at a time, but hopefully a little calmer and in two weeks I will be 63, so it is always good to learn something

> new. It gives you, you have an open mind is a good thing and meeting people who are very well versed in yoga is lovely.

Participant #105 stated:

> Definitely um just to, you know, learn what I've learned over the time in class to incorporate that in my life on daily basis and also just to slow down a bit and find a way to take the chaos out of some times and just going to myself…and being able to move all the busy-ness and find a quiet time even if it is just for a very small amount of time.

In response to question eight ("Since you participated in the yoga program, has your daily life changed? If so, how?"), participants responses were classified into four themes: (a) *Practicing Yoga* (n = 11; e.g., practicing at home, teaching family, using in nature, uses discipline to practice to feel better, intention to practice daily, challenge is to maintain practice, does postures to increase energy and improve breathing); (b) *Using Breathing/Relaxation/Meditation (n = 4); (c) Increased Quality of Life* (n = 8; e.g., slowed down from fast pace, prioritizing differently, taking more breaks, shift from overwork, activities of daily living increased, physical quality of life improved (more energy, improved sleep, easier to move, better posture, more agile, decreased (stomach) pain, less pain leads to less stress, less defeat, more energy); and (d) *No Change* (n = 5). The theme of practicing yoga is evident in a quote from participant #107:

> I do meditate when I am stressed, like I do the closing my eyes and breathing in and breathing out. Like it scheduling of my life has not changed, no changes to the schedule but I do the meditation. And I like (ūrdhva hastāsana). I like to do

> that to give myself energy if I am feeling slouchy or something because I think it helps me with breathing and really energizing the top half of my body because I need a lot of energizing throughout the day (#107).

The theme of Increased Quality of Life is evident in a quote from participant #101:

> I think it has changed because I am feeling less pain, which um the obvious benefits of that are having more energy, um, you know, feeling less defeated or grumpy because I am feeling the pain. I think you know pain, sort of ah, colours your view of how you can deal with things when there is less pain, I think I can deal with daily stressors that come out (#101).

In response to question nine ("Have there been any shifts in how you understand or think about your purpose in life?"), participants reported two themes: (a) *Self as Priority* (n = 5; e.g., awareness to reduce pressure to conform to other's expectations, invest in myself, prioritize self, more confident (in part from yoga), reinforced current priorities, appreciation of life's narrative/journey); and (b) *None* (n = 13). Participant #204 explained that it prompted reflections on the meaning of his life:

> It has given me an understanding and appreciation of, what I've gone through I guess. It is a transition still of what I am here for or what I want to continue doing. But it has given me an option, it's an option that I can apply to whenever it is necessary and needed so there and that's where – again it's one of the tools I can choose to keep in my toolbox of what is necessary. You know people have various tools that needs for themselves and this is one of the tools I would keep for me when it is necessary.

Participant #104 stated,

> I think this gave me permission that you know what, I can have a few days to myself per week. To look after myself because that makes me better and therefore, I'm better at what I do.

In response to an open ended question about any other feedback ("Is there anything else you would like to say about your experience?"), participants responses were classified into five themes: (a) *Appreciation of Yoga* (n = 8; e.g., yoga made an impact, relaxation was helpful, been a pleasure, reduced pain, told pain clinic doctor and general physician, desire to carry forward positive habits, wants to continue after surgery, great experience); (b) *Recommendation to Have Yoga as Part of a Rehabilitation Program* (n = 9; e.g., thinks yoga is helpful for traumatic experience, thinks mindfulness is accessible and low cost, would like yoga at the LC, would benefit community, would like yoga program to continue, would like the yoga program to be offered regularly); (c) *Specialization of Yoga* (n = 5; e.g., there is a need for yoga for lower body parts in SCI, there's a need to develop props (standing table) for quadriplegics, there was an opportunity to find movement again, appreciation of adaptation and pacing, more information on meditation would be helpful); (d) *Practice Materials* (n = 2; e.g., would like home practice materials); and (e) *No Further Comment* (n = 4). Some of these recommendations are clear in the response from participant #207 and #106.

> Just as far as this study goes I hope there is more research into props or accessories or techniques to allow quadriplegics to engage in yoga more comprehensively. I did find my condition was limiting even in this class compared to a lot of the other participants. Something like using a standing table

> would be fantastic because it removes the tension and need for balance all the time (#207).
>
> It was positive and I think it should be rolled out to all patients, not just spinal cord injury patients, other patients that are going through traumatic life changes events…it could be very beneficial for them…especially people that have arthritis, that have constant pain in their joints. I think yoga could definitely help them, other than prescription drugs, meditation could be another vehicle. Think about themselves too…and find others sources of helping themselves…we are so much more than what we think we are (#106).

In summary, the participants reported therapeutic gains in mental and emotional experience (e.g., feeling relaxed, calm, positive), physical function (e.g., increased flexibility, strength, mobility, stamina, circulation), improved posture (e.g., alignment of the neck and spine), and decreased pain (e.g., reduced pain quality, new response to pain). The theme of decreased pain was present in several questions, including question one/two (*Decreased Pain*; e.g., reduced pain in specific body parts), question four (*Ability to Face Physical Challenges*; increased ability to use pain management strategies, ability to notice pain), and question five (*Decreased Pain and Ability to Use Yoga to Manage Pain*; e.g., reduced pain, new response to pain). They described increased levels of mindfulness in several of the interview questions (e.g., openness, present-mindedness, acceptance, non-reactivity) and an ability to let go of what is not important. This theme was present in question one/two (sub-theme of *Meditation/Mindful Awareness*; e.g., paying attention, increased awareness), question four (*Embodying Mindful Principles*; e.g., accepting, letting go), question five (*Increased Awareness*; e.g., new awareness

of body parts and sensations, paying attention,), question six (*Connection to the Present*; e.g., living in the moment, more tolerant and accepting, awareness of thoughts) and question eight (*Breathing/Relaxation/Meditation*). They reported that they acquired a new awareness of the physical body and experienced gratitude for the parts of the body with mobility or health. They learned to overcome physical limits (question one: *Specialization of Practice with Modification/Props*; e.g., ability to do more than thought, overcoming limits to quadriplegics, and question five: *Overcoming Limits*; pushed self to do more, improved drastically in a short period of time), and found they were able to participate in way that they hadn't expected.

They enjoyed learning refined movements, especially in the context of limited motor function. They noticed relationships between stress, pain, and breathing, and they used the various practices (breathing, meditation, and relaxation exercises and postures) to assist with stress and pain reduction (question one: *Using Breathing as a Tool*, question eight: *Using Breathing/Relaxation/Meditation*). Some participants noted that this enabled them to do more than usual (e.g., cooking, cleaning) and reported a consequent improvement in quality of life (*Increased Quality of Life*; e.g., prioritizing differently, taking more breaks, shift from overwork, activities of daily living increased, physical quality of life improved, more energy). They also stated that they felt more resilient, which was evident in question one (*Improved Psychological State*; e.g. positive outlook, happier), question four (*Increased Capacity to Cope with Stress and Emotions/Shift in Priority*; e.g., new way of handling stressful situations, more adept at resolving challenges, lower stress, ability to prioritize differently), and question seven (*Resilience*; e.g., more optimistic, positive perspective, manage stress). By extension, they noticed an increase in physical abilities (question four: *Ability to Face Physical Challenges*, question five: *Increased Physical Capabilities*). Participants noticed a shift in perspective and developed a new ability to

commit to and prioritize themselves. This reorientation to the self was evident in question four (*Self as Priority*; e.g., putting myself first, realistic expectations of the myself), question six (*Commitment to the myself*; e.g., taking time for myself, prioritizing myself, taking care of myself, self-care) and question nine (*Self as Priority*; e.g., invest in myself, more confident, reduced pressure to conform to other's expectations). They planned to use yoga to mitigate serious health impacts. Participants enjoyed the yoga instructors and felt encouraged by the social component of the class. Participants found the props and modifications helpful and noted improved posture and depth of practice with the degree of specialization of the program for SCI.

In terms of recommendations, most participants thought that yoga should be incorporated into standard rehabilitation programs for individuals experiencing disability or traumatic experiences. Some participants with limited mobility stated that increased specialization or further development of props for individuals with quadriplegia would be helpful and they would have enjoyed lower body postures. Overall, participants were satisfied with the yoga program and would like for the program to continue in an ongoing manner. The themes gleaned across the ten questions indicate that the expectations of increased relaxation/improved breathing, learning about the physical poses, improved physical function, decreased pain, and obtaining new techniques, were met.

Summary of Study 3

In summary, the results from the quantitative data revealed improvements for depressive symptoms, and increased levels of self-compassion in individuals with SCI who participated in a specialized yoga program. The quantitative data also suggests that these individuals may have experienced increased levels of mindfulness (general mindfulness, mindful non-reactivity, and

mindful observing), which is supported by the qualitative reports. According to the semi-structured interviews, the participants reported improved functional gains (e.g., decreased pain, increased strength, improved posture), and improved psychological status (e.g., relaxation, positivity). Many participants reported increased resilience, the acquisition of new tools to manage pain and difficult emotions, and a shift in perspective to prioritize self-care. In line with the findings from Studies 1 and 2, they reported enjoying participating with others and recommended yoga for individuals experiencing disability, pain, or trauma. Participants provided helpful recommendations to advance and refine the tailoring of yoga for individuals with SCI, with respect to props, specific movements, and contents of a yoga program. Overall, the results indicate that yoga is an accessible mind-body intervention for individuals with SCI and promote vitality and well-being beyond symptom amelioration.

Chapter 6: General Discussion

The primary purpose of this dissertation was to develop and evaluate specialized yoga programs for individuals experiencing severe health impacts of a chronic nature, chronic pain, limited mobility, and disability. The first pilot study evaluated a once-weekly, eight-week yoga intervention for individuals with CCDD. The second pilot study evaluated a once weekly, eight-week yoga intervention for individuals with SCI. The third study, a pilot RCT, evaluated a twice weekly, six-week yoga intervention for individuals with SCI, when compared to a wait-list control group. All of the yoga interventions used a comprehensive approach to yoga, employing seated yoga postures, breath awareness exercises, mindfulness practices, and brief concentration or meditation practices. The second study incorporated brief yoga philosophy teachings and the first and third studies employed a more formal system of didactics. This discussion is divided into three sections. In Section 1, I will summarize the findings from each of the three studies; in Section 2, I will summarize clinical and research implications of these findings; and in Section 3, I will discuss future research possibilities and concluding statements.

Section 1: Summary of Findings

Study 1.

CCDD and multi-morbidity have been identified as complex health disease states that require ongoing health care treatment. With tertiary hospital settings in Canada utilizing acute care models, they are not equipped to address the health needs of this population. Consequently, the health care burden of treating these individuals is high, and the converging physical and psychological health impacts for these individuals are not adequately treated. Yoga is an example of a treatment option that addresses both psychological experience (anxiety, mood) and physical

function (mobility, strength, range of motion). Although there are a plethora of research trials evaluating yoga for various chronic and debilitating health conditions, to my knowledge, at the time of the design of these projects, there were no trials that evaluated the utility of a yoga program for individuals with CCDD. Study 1 evaluated pain, psychological factors, and spiritual constructs in individuals with CCDD. The results suggest that a specialized yoga program may reduce anxiety and the magnification aspect of pain catastrophizing, and increase levels of self-compassion in individuals with complex multi-morbidity in a continuing care rehabilitation hospital. In addition, self-compassion mediated levels of anxiety, highlighting this construct as a potential mechanism of yoga. Participants were provided with didactics on yoga philosophy concepts of self-compassion, non-harm, and self-kindness, and were encouraged to integrate these principles as they practiced the *yogāsanas*. By doing so, they may have circumvented ruminative and anxiety-related cognitive tendencies. This is particularly important as it points to elements of the yoga intervention that were impactful and may underlie psychological change process from pre- to post-intervention.

The qualitative data analysis revealed that participants noted improvements in physical function (e.g., improvements in strength, sleep, health symptoms, flexibility, and pain) and mental health (e.g., stronger ability to confront and face problems, an ability to relax and a sense of peace). The participants found the practice safe and simple, they enjoyed participating with others and found it generally helpful. In terms of challenges, they reported challenges with technology, challenges with increased awareness of internal experience, and initial pain. Participants also reported a shift in perspective, a deeper respect for the body, a greater connection to the self, increased sense of present-mindedness, increased independence and activity engagement, a desire to take the practice to life, and a sense of wanting to give to others.

They also believed that yoga should be used with rehabilitation for debilitating conditions and made some logistical recommendations. Half of the participants who completed the program did not report any negative effects and some reported no changes or mild changes. Most participants had most, if not all, of their expectations met.

The qualitative and quantitative data from study one partially confirm hypotheses one and two, and confirm hypothesis three. Hypothesis one proposed that scores on pain, pain catastrophizing, stress, anxiety, depression, and experiences of injustice would decrease from pre- to post-intervention. Scores on anxiety and the magnification aspect of pain catastrophizing decreased from pre- to post-intervention. Hypothesis two proposed that scores on mindfulness, self-compassion, and spiritual well-being would increase from pre- to post-intervention. Scores of self-compassion increased from pre- to post-intervention. Hypothesis three proposed that yoga would positively impact the lived experience of individuals receiving CCC or MR with respect to perceptions of body, health, sense of self, future and purpose in life, as well as experiences of daily life. This hypothesis was supported in that participants reported improvements in health, a deeper respect for their body, a deeper connection to self, a desire to leave the hospital and a change in daily activities. Overall, the results from this study suggest that yoga is a safe, accessible and modifiable activity that is well-tolerated by and yields therapeutic gains for individuals with CCDD. The two main limitations to Study 1 are the small sample size and the absence of a randomized, controlled design.

Study 2.

SCI is a debilitating and life altering condition associated with pain, psychological sequelae, disability and secondary health impacts. Rehabilitation in the post-SCI period is often focused on physical treatment and psychological interventions to support the recovery process,

which may include access to resources to foster and reduce barriers to physical activity engagement. Yoga is an adaptable and accessible mind-body practice that has demonstrated functional and emotional gains in health populations experiencing limited mobility. Study 2 evaluated pain, psychological experiences, and mindfulness in individuals with SCI. The quantitative results revealed no significant differences in scores on any measures from pre- to post-intervention. However, the qualitative analysis revealed that participants may have experienced gains in these constructs. Participants reported increased present-mindedness (e.g., increased awareness, new way of being in old experience), freedom from regular experience (e.g., free from mental baggage, new lease on life), physical awareness or changes (e.g., focus on body parts, mobility), relaxation (e.g., calmness), investing in the self or achievement (e.g., time spent concentrating on myself), environment (e.g., instructor, group membership), taking the practice to everyday life (e.g., practicing at home, dealing with stress better), and pain relief (e.g., relief from overwhelming aspect of pain, release chronic pain). Participants expected to experience a new experience of the self, more activity engagement, stress and pain relief and social support, and these expectations were met. Participants reported being satisfied with the program and that they found it to be a valuable therapeutic tool. They recommended that yoga should be incorporated into rehabilitation programs for individuals with disabilities and made some logistical proposals for improvement.

Hypothesis one was not confirmed, while hypotheses two and three were confirmed. Hypothesis one proposed that participants would demonstrate improvements in relevant pain, fatigue, psychological, and mindfulness constructs from pre- to post-intervention. This hypothesis was not confirmed. Hypothesis two proposed that participants would be satisfied with the yoga program and that scores on measures evaluating yoga satisfaction would indicate

moderate levels of satisfaction. Participant's scores on the Yoga Satisfaction Scale were in the moderate-high range, as evidenced by no scores lower than 7/10 for each of the three aspects: enjoyable, relaxation, and would attend again. They also reported being satisfied with the program in the interviews post-intervention. Hypothesis three proposed that analysis of qualitative interviews with the sample would reveal the positive impact of yoga on the lived experience of individuals with SCI. This hypothesis was confirmed as qualitative data indicated a number of therapeutic benefits (e.g., decreased stress, calmness, strength building, general pain relief) and personal growth beyond symptom reduction in individuals with SCI (e.g., increased self-awareness, new ways of being in old experience). The tools and resources provided by the yoga program resulted in physical and emotional gains, and supported participants to overcome personal barriers in finding a greater connection to the self, sense of meaning, and present-minded experience. Overall, the results from this study suggest that yoga is a safe, accessible and modifiable activity that is a promising mind-body intervention for individuals with SCI.

Study 3.

The third study built on the design and results from Study 2. Study 3 evaluated pain, psychological experiences, and mindfulness in individuals with SCI, using a RCT design. Individuals with SCI who were randomized to a yoga intervention reported lower levels of depression and increased levels of self-compassion when compared to participants randomized to a WLC group at post-intervention. The two groups were combined into one group to increase power, and analysis using pre- and post-intervention scores suggested that participants with SCI who participate in a specialized yoga program also demonstrated greater levels of mindfulness (total scale score, non-reactivity subscale, and observing subscale) at post-intervention.

Participants were interviewed about their experiences in the yoga intervention and analysis revealed that participants found the program meaningful and valuable. They reported improved mental and emotional experience (e.g., feeling relaxed, calm, positive), physical function (e.g., increased flexibility, strength, mobility, stamina, circulation, posture), and decreased pain (e.g., reduced pain quality, new response to pain). They described embodying mindfulness principles (e.g., acceptance, present-mindedness, openness) and a shift towards non-reactivity, which is consistent with the quantitative results that mindful non-reactivity increased from pre- to post-intervention. They reported that they acquired a new awareness of the physical body and experienced gratitude for the parts of the body with mobility or health. They learned to overcome physical limits and enjoyed learning refined movements, especially in the context of limited motor function. They noticed relationships between stress, pain, and breathing, and they used the various practices learned in the yoga program in daily life to assist with stress and pain reduction. They reported having more tools and a greater capacity to deal with everyday challenges. Some participants noted that this enabled them to engage in more activities than usual (e.g., cooking, cleaning) and reported a consequent improvement in quality of life. Participants noticed a shift in perspective and developed a new ability to commit to and prioritize themselves. They also stated that they felt more resilient when thinking about their future and planned to use yoga to mitigate serious health impacts (e.g., diabetes, arthritis). Participants enjoyed the yoga instructors and felt encouraged by the social component of the class. Participants found the props and modifications helpful.

In terms of recommendations, most participants thought that yoga should be incorporated into standard rehabilitation programs for individuals experiencing chronic illness and disability. Some participants with limited mobility stated that increased specialization or further

development of props for individuals with quadriplegia would be helpful. Overall, participants were satisfied with the yoga program and would have liked for the program to continue in an ongoing manner. The themes generated in the interviews indicated that the expectations of increased relaxation/improved breathing, learning about the physical poses, improved physical function, decreased pain, and obtaining new techniques, were met.

The results of Study 3 do not confirm hypothesis one, partially confirm hypotheses two and three, and confirm hypothesis four. Hypothesis one proposed that participants in the IY group would demonstrate greater improvements on scores of a measure of psychological inflexibility from pre- to post-intervention, when compared to the WLC group. This hypothesis was not confirmed. Hypothesis two proposed that participants in the IY group would demonstrate greater improvements in relevant psychological constructs (depressive symptoms, anxiety, self-efficacy, posttraumatic growth, resilience, mindfulness, and self-compassion) and pain (intensity, interference, catastrophizing) from pre- to post-intervention, when compared to the WLC group. This hypothesis was partially confirmed as participants in the IY group demonstrated increased levels of self-compassion and decreased levels of depressive symptoms when compared to the WLC group, at post-intervention. Hypothesis three proposed that after combining the two groups, participants would show within group improvements in all variables (pain, pain interference, pain catastrophizing, depression, anxiety, psychological inflexibility, self-efficacy, posttraumatic growth, resilience, mindfulness, and self-compassion) from pre- to post-intervention. This hypothesis was partially confirmed in that participants demonstrated increased levels of self-compassion and mindfulness, and decreased levels of depressive symptoms at post-intervention when compared to pre-intervention.

Hypothesis three proposed that analysis of qualitative interviews with the sample would reveal the positive impact of yoga on the lived experience of individuals with SCI with respect to physical and mental health, perceptions of body, sense of self, future and purpose in life, and in experiences of daily life. This hypothesis was confirmed as qualitative data indicated a number of therapeutic benefits, such as increased feelings of relaxation, reduced stress, improved physical function and pain relief. Importantly, participants reported obtaining new tools and that they were using the yogic practices in daily life. Participants reported a sense of overcoming limits, an increased capacity to be resilient to the challenges of life. There was a shift in perspective to prioritize themselves and a new commitment to health and well-being. Therefore, the results from this study provide empirical evidence that yoga improves psychological experiences in individuals with SCI.

Section 2: Clinical and Research Implications

Improvements in Psychological Status.

The finding that anxiety decreased in the context of the eight-week program in Study 1 is consistent with RCTs that demonstrate improvements in anxiety and health outcomes in individuals with chronic diseases (diabetes or chronic low back pain) who participated in a yoga intervention when compared to walking or exercise/counselling control groups (McDermott et al., 2014; Tekur, Nagarathna, Chametcha, Hankey, & Nagendra, 2012). A recent cross-sectional assessment of a large sample of individuals with a range of chronic illnesses found that self-reported duration (practice session length and number of months practicing) predicted anxiety. The authors concluded that increased doses of yoga practice may help individuals respond to illness with lower levels of anxiety (Telles, Pathak, Kumar, Mishra, & Balkrishna, 2015b). As

well, systematic reviews document improvements in anxiety for several health populations that have participated in a yoga intervention, such as cancer, stroke, and irritable bowel syndrome (Buffart et al., 2012; Desveaux, Lee, Goldstein, & Brooks, 2015; Schumann et al., 2016).

The lower depression scores at post-intervention for the IY group in Study 3 is consistent with improvements from other yoga trials evaluating mood for limited mobility populations and with previously documented evidence regarding the efficacy of yoga for clinical depression, according to the Oxford CEBM method of appropriateness (Balasubramaniam et al., 2013). Depression was found to clinically improve in individuals with post-stroke hemiparesis after participation in a 10-week yoga trial when compared to no treatment controls (Immink, Hillier, & Petkov, 2014). For participants with osteoarthritis, participation in a twice weekly, 8 week, "Sit 'N' Fit" yoga program resulted in improvements in depression symptoms when compared to an attention control group (Park, McCaffrey, Newman, Cheung, & Hagen, 2014). A pilot trial evaluating the utility of a yoga plus intensive physical therapy for individuals with multiple sclerosis found improvements in depression when using the same scale as in the present study (HADS-D) (Chobe, Bhargav, Raghuram, & Garner, 2016). In addition, a pilot RCT evaluating the impact of an innovative yoga program consisting of classical *prāṇāyāma*, relaxation, and meditation practices for individuals with Guillain-Barré syndrome found improvements in depression for individuals randomized to the yoga group, when compared to individuals receiving standard rehabilitation program, as measured by HADS-D (Sendhilkumar, Gupta, Nagarathna, & Taly, 2013).

The classification of SCI in this present study was broad and included demyelinating diseases of the central nervous system, and so the results of similar studies emphasizing the *prāṇāyāma* and meditative components of a yoga program indicate that these accessible and

more subtle elements of yoga may be useful and applicable for individuals who have limited range of motion or who have had trauma to the central nervous system.

The benefits of yoga extend beyond decreasing negative cognitive-affective experiences and can also serve to generate new experiences with mindfulness. Total levels of mindfulness and the subscales of observing and non-reactivity increased from pre- to post-intervention in the third study, when the participants with SCI were evaluated as one cohort. These findings parallel results from trials that evaluated mindfulness in the context of a yoga intervention for individuals with chronic pain and limited mobility. Specifically, an eight-week pilot yoga program for individuals with fibromyalgia resulted in improvements in the total scale and in the describing and non-reactivity to inner experience subscales of the FFMQ (Curtis, Osadchuk, & Katz, 2011). Improvements in two subscales of the FFMQ, non-judging of inner experience and acting with awareness, were observed for cancer survivors who participated in a "Yoga Thrive" 7-week yoga intervention (Mackenzie, Carlson, Ekkekakis, Paskevich, & Culos-Reed, 2013). The fact that different subscales demonstrated improvements across the studies may be attributable to the differences in the intervention's philosophical focus, specific attentional or meditative training, variations in the teaching style, or to the specific health populations. In addition, there are also qualitative reports of increased present-mindedness (being in the moment, letting go, new way of being in old experience, increased awareness of body, increased concentration) for individuals with SCI who participated in an 8-week yoga program (Curtis et al., 2015). Taken together, these studies indicate that yoga programs that are comprehensive in nature and that include philosophical concepts that bridge the two disciplines of yoga and mindfulness (e.g. witness consciousness, one pointed concentration, non-judgement, openness), have demonstrated increased levels of mindfulness in individuals with health-related impacts or disability.

These changes in anxiety and depressive symptoms and increased levels of mindfulness are supported by qualitative reports across the studies. In all of the studies, participants reported increased feelings of relaxation, calmness, and present-mindedness. Many participants reported improved mental health in relation to improved breathing or breath awareness. For example, in Study 1, the theme of relaxation and breath were combined into one theme, which included a sense of contentment and letting go. In classical yoga philosophy, the breath is considered to a tool for managing the mind and is viewed as a link between the physical and mental/emotional realms of experience (Iyengar, 2010). Participants from all studies reported increased levels of mindfulness, such as non-judgment of body sensations, more acceptance, an ability to live in the moment, letting go, a sense of adventure in awareness, paying attention, and slowing down.

Corroborating the increases in mindfulness are increases in self-compassion, which is an overlapping third wave construct. In Study 1, self-compassion increased significantly from pre- to post-intervention. In Study 3, levels of self-compassion at post-yoga intervention were significantly higher for individuals in the yoga group when compared to the wait-list control group, and at post-intervention for the combined group. These finding suggest that participants of a specialized yoga program for individuals with disability experienced a change in psychological orientation to pain and suffering. Interestingly, the quantitative results of higher levels self-compassion at post-intervention were not explicitly supported by the qualitative data. Participants reported increased levels of relaxation and calm, rather than increased self-compassion. However, participants did endorse each of the substituent parts of self-compassion; mindfulness (letting go and acceptance), self-kindness (prioritizing the self, taking care of the self), and shared humanity (social community element) across many of the questions, so it may be that they simply didn't identify the shift as self-compassion. It may also be that the

quantitative shift captured a behavioural form of self-compassion in action, such that participants engaged with their life differently. They reported taking time to practice, prioritizing their own well-being, and a desire to nurture and care for themselves. One of the items on the SCS-SF that comprises the self-kindness sub-scale (When I'm going through a very hard time, I give myself the caring and tenderness I need) may have captured this behavioural element of self-compassion.

The quantitative findings parallel the results from a yoga research trial in which self-compassion increased in individuals living with an implantable cardioverter defribrillator, who were randomized to a once weekly, eight-week yoga intervention, when compared to a usual care group (Toise et al., 2014). The yoga literature is lacking studies that have evaluated self-compassion in the context of yoga trials for clinical populations, but there are some studies that have evaluated yoga programs that involve the meditation components of yoga in non-clinical populations. Caregivers of individuals with Alzheimer's who were randomized to a combined yoga and meditation program displayed increases in self-compassion from pre- to post-intervention when compared to a control group (Danucalov, Kozasa, Afonso, Galduroz, & Leite, 2015) and medical students who participated in an "Embodied Health" program consisting of yoga, meditation and neuroscience didactics, displayed higher levels of self-compassion and self-regulation after the program (Bond et al., 2013). In addition, low-income or insured individuals who participated in a mindfulness, self-compassion and yoga program, according to a single group, repeated measures design, were found to have lower levels of anxiety and depression post-intervention (Falsafi & Leopard, 2015). These studies indicate that levels of self-compassion increase with yoga practice, which may be in part due to shared elements of mindfulness, acceptance, and openness.

Despite the lack of significant findings regarding experiences with perceived injustice, resilience, self-efficacy, and posttraumatic growth, across the three studies, qualitative themes revealed shifts in some of these areas as a result of a yoga program. For instance, in Study 1 and 3, participants reported increased resilience and self-efficacy, as evidenced by a stronger ability to confront and handle physical and emotional challenges, and the acquisition of new tools for improving well-being. Participants also reported discovering that they could do more than they thought was possible and an overcoming of limits. Although participants did not report growth on account of their trauma/injury, they did report self-growth through the process of engaging with yoga. Participants in all studies endorsed a shift in perspective characterized by a deepening in the sense of self, or connection to the body. In Study 1, participants reported increased harmony within the self and of listening to or realizing the body. In Study 2, participants reported growth in terms of an appreciation of the body and ability to cultivate calmness and peace through the use of the practices. In Study 3, participants reported a new appreciation for parts of the body that have mobility and more awareness of the body and mind. Taken together, these themes highlight the transformative nature of these yoga interventions beyond traditional medical model conceptualizations of mental health in relation to self-concept or broadly, with the experience of the self. Alternate constructs of well-being that extend beyond symptoms associated with disease states, such as purpose of life, spirituality, compassion, and connection to others, have been endorsed as important health-related concepts in yoga research (Khalsa et al., 2016a).

Pain and Pain-related Cognitions.

Although none of the studies resulted in a decrease in quantitative measures of pain intensity or interference, there were qualitative reports of pain relief across the three studies and participants in Study 3 reported that they also developed new responses to pain and acquired new pain management strategies. It may be that the questionnaire used to measure pain (BPI) was limited in scope as it used gross numeric rating scales for worst, least, average, and present pain levels, and did not query for pain quality or type. The use of more specific pain measurement tools, such as the McGill Pain Questionnaire, may provide more detailed information about the type (e.g., neuropathic, musculoskeletal) and quality (e.g., affective, cognitive-evaluative) of pain and whether various types of pain respond differently to a yoga practice.

Results from the first study indicated that participants experienced a reduction in the magnification aspect of pain catastrophizing (e.g., I become afraid that the pain will get worse). Although pain catastrophizing has been less well studied in yoga trials, there are two studies (one pilot, one RCT) that documented lowered levels of pain catastrophizing from pre- to post-yoga interventions for samples of women with fibromyalgia (Carson et al., 2010; Curtis et al., 2011), which is consistent with the present results. Pain catastrophizing is a strong predictor of pain severity, pain-related interference, disability, depression, and altered social support networks (Quartana, Campbell, & Edwards, 2009), and is associated with physical function deterioration in individuals with joint pain and comorbidity (Hermsen et al., 2016), highlighting it as a useful target for interventions that are designed to increase functional ability in individuals with multi-morbidity. Other pain-related, psycho-social factors implicated in the fear avoidance model of chronic pain (pain disability) or in the treatment of chronic pain (pain acceptance) have been shown to improve with yoga practice (Evans et al., 2013). These findings, taken together, provide some evidence that yoga may help to reduce the threat value attributed to pain stimuli,

rather than pain reduction, in individuals with CCDD. Questionnaires that capture other components of pain-related cognitions, such as chronic pain acceptance, sensitization to pain traumatization, or pain anxiety, may also provide valuable insight into the ways that individuals with CCDD or SCI respond to or approach pain. The participants across the studies reported therapeutic gains to the degree that they recommended yoga to be used in rehabilitation settings where individuals experience debilitating disability or any severely traumatic experience.

Mechanisms of Action.

The finding that self-compassion mediated changes in anxiety in Study 1 provides some support for role of self-compassion as a protective agent in distressing psychological experience and in helping to understand how yoga may be exerting its mechanism of action. This construct has been identified in the yoga literature as one of seven possible mediators of yoga and stress; other mediators include psychological (positive self-affect and mindfulness) and biological (activity in the posterior hypothalamus, and inflammatory and endocrine responses: C-reactive protein, Interleukin-6, cortisol) pathways for therapeutic effects (Riley & Park, 2015). Self-compassion has been demonstrated to be a more robust predictor of symptom severity (e.g. anxious and depressive symptoms) and quality of life than mindfulness in a large community sample of individuals seeking self-help for anxious distress, and predicts emotional well-being more consistently than mindfulness in a sample of youth participating in a five day meditation retreat (Galla, 2016; Van Dam, Sheppard, Forsyth, & Earleywine, 2011). Self-compassion has also been shown partially explain the relationship between mindfulness with depression and negative affect in cross-sectional sample of young adults (Bluth & Blanton, 2014). On the other hand, self-compassion and mindful attention were not found to mediate changes in emotional

stability in high school students who participated in a 16 week yoga program, when compared to students who participated in physical education as usual, highlighting that this construct may be more amenable to facilitating secondary mental health benefits in individuals experiencing illness-related duress (Daly, Haden, Hagins, Papouchis, & Ramirez, 2015).

Self-compassion may impact how individuals cope with chronic and debilitating illnesses; it has been shown to change emotional responses, such as levels of shame and increase positive coping behaviors in individuals living with HIV (Brion, Leary, & Drabkin, 2014). In addition, it is positively associated with both intentions to engage with and practice of health-promoting behaviours (e.g., eating habits, stress management, exercise, sleep, etc.) with indirect effects through adaptive emotions (e.g. health self-efficacy, positive affect), in community samples of Canadian adults (Sirois, 2015; Sirois, Kitner, & Hirsch, 2015). Self-compassion predicts positive attitudes in the elderly, potentially serving as a buffer against the inevitable challenges associated with age-decline (Allen & Leary, 2014), which is relevant as the risk of multi-morbidity increases with age. Higher levels of self-compassion have been found to be associated with lower levels of catastrophizing, avoidance, and rumination in chronic pain patients who were presented with vignettes involving a violation of social contract, and has been found to predict affect, pain disability and pain catastrophizing in obese patients with chronic pain (Purdie & Morley, 2015; Wren et al., 2012). These studies point to self-compassion as a way of opening to and experiencing distressing experiences and by doing so, circumventing or offering a protective buffer against engrained ruminative or self-barraging cognitive patterns and to positively impact health and functioning (Wren et al., 2012).

Although mindfulness was not a mediator of positive psychological changes in Study 1, previous yoga trials have reported that mid-intervention levels of mindfulness mediated changes

in pain catastrophizing from pre- to post- yoga intervention in women with fibromyalgia (Curtis et al., 2011). The relationship between mindfulness, anxiety, disability, and self-compassion have been explored in individuals with Generalized Anxiety Disorder; these individuals have been shown to have lower levels of self-compassion and mindfulness than healthy stressed controls and mindfulness was a better predictor of disability than actual anxiety symptoms, drawing potential protective effects of mindfulness on disability individuals with chronic worry and physiological symptoms (Hoge et al., 2013). It has also been shown to partially explain the relationship between mindfulness with depression and negative affect in cross-sectional sample of young adults (Bluth & Blanton, 2014). Further examination between psychological well-being, mindfulness, self-compassion and disability for individuals with CCDD or SCI in the context of a yoga intervention is warranted.

Attending to the Signals of the Body: New Pathways.

The role of interoception, which is a complex and multi-modal bodily system involving a sense of body parts in space (proprioception) and the act of attending, appraising, and responding to afferent body signals (Gard, 2015), has been considered one of yoga's underlying mechanisms of action through the process of exposure and re-conditioning (Curtis et al., 2010). It is proposed that mind-body interventions, such as yoga, may interrupt habitual ways of perceiving and interpreting body sensations within the context of higher order cognitive processes, such as goals and intentions, by connecting an individual with the present moment and with their agency for personal change (Farb et al., 2015). In addition, it has been proposed that higher level brain networks that are activated by yoga practice may serve to inhibit negative appraisals, rumination and emotional reactivity while lower level neural networks may down regulate physiological

responses to stress, such as inflammatory markers and vaso-pulmonary restriction, through the activation of the parasympathetic nervous system (Gard et al., 2014). This is relevant in interpreting the results from Study one that pain catastrophizing decreased from pre- to post-interventions, as pain catastrophizing involves exaggerated or negative cognitive-emotional appraisal of painful stimuli as threatening, is accompanied by perceived helplessness, and is associated with aberrant central nervous system processes, such as cytokine or hypothalamic-pituitary-adrenal responses to pain, and activation of neural regions associated with processing affective components of pain (Quartana et al., 2009).

Yoga Interventions.

Given the breadth and variety of yoga interventions that are used in yoga research, it is imperative to properly document the specific components of a yoga program and how interventions are tailored for various populations (Elwy et al., 2014; Sherman, 2012). The present studies used integrated yoga interventions that incorporated many "limbs" or aspects of yoga, including breathing practices (*prāṇāyāma*), physical postures (*āsana*), yoga philosophy (*jñāna*), mindfulness (*smṛti sādhanā*), and meditation/relaxation (*dhāraṇā, dhyāna*) techniques. Although such a comprehensive program is not a new format in the yoga literature, (Sherman, 2012) this combination of limbs has not been applied to a CCDD or SCI population and was innovative in the consideration and application of yoga philosophical concepts. As well, these programs used yoga philosophy concepts that are emerging in the field, such as *kośa* theory and āyurvedic elements of practice (*śodhana, śoṣana, śobhāna, śamana*), as well as specific didactics on Patañjali's Yoga Sūtras. The interventions were designed in accordance with the teaching philosophy of classical yoga, in terms of progression of instruction with the skill development of

the students/participants, in modelling of the ethical principles through the style of teaching, the use of therapeutic variations to classical poses, and of the selection of practices that are considered within this yogic lineage to both calm the nervous system (e.g., *prāṇāyāma* and *dhāraṇā*), to promote vitality, and to lift depressive, or "heavy states of mind." (Iyengar, 2010). Studies 1 and 3 documented the yoga philosophy concepts that were selected as appropriate for these populations and to assist with replicability.

Limitations.

There are limitations to the present studies. The present studies all used a small sample size, which limits power and increases the possibility Type 2 errors. The primary weakness of Study 1 and 2 is the absence of control groups, which is a shortcoming that is widespread in the yoga research literature, and makes it impossible to attribute the improvements observed to the yoga practice itself. Logistical limitations for Study 1 included participant difficulty in using the MP3 players and as a result, reducing homework engagement and completion, which may have reduced overall efficacy of the eight-week yoga intervention. As well, due to scheduling difficulties, it was impossible to hold the yoga program in a consistent room at the hospital from week-to-week which created participant confusion, and a late start to the classes. In Study 3, there were also a higher number of individuals of Caucasian descent in the WLC group, and this discrepancy should be considered when interpreting the results.

All three studies were limited by the exclusive use of self-report measures and a lack of physiological parameters. Physical measures of circulatory or cardiovascular function (e.g. heart rate), salivary measures of endocrine or immune markers (e.g., cortisol, interleukin-6, interleukin-8), neuroimaging techniques to evaluate neural activity (e.g., MRI scans) have all

been utilized in the yoga literature (Schmalzl, Streeter, & Khalsa, 2016) and these studies may have benefitted from these objective measures of physical health and function. Active ingredients of a yoga program, such a physical exercise, social support, and relaxation training, were not controlled for in any of the studies. The dismantling approach has been criticized for discounting the synergistic effect of the substituent parts in concert. On the other hand, it has been recommended to evaluate the separate practices/postures (e.g., back bends versus twists) or components (e.g., breathing practices versus philosophy) of a yoga program, despite the clear limitations that this type of design presents for the yogic paradigm (Khalsa et al., 2016a). In addition, the nature of participating in a yoga program precludes the ability to blind participants to the treatment condition, thereby limiting the rigor of research design.

A further limitation of this dissertation is that the self-report measures differed across the three studies and this prevented direct comparison of results. For example, Study 1 and 3 evaluated mindfulness using the FFMQ-SF while Study 2 evaluated mindfulness using the TMS and the CAMS-R. The difference in selected measures was done for practical and theoretical reasons. In terms of practical reasons, Study 2 involved a program evaluation component as part of standard practice at the LC. Hospital studies involve interdisciplinary relationships and existing standards of care; at the LC, the TMS is a measure that is routinely used for program evaluation and for this reason, this measure was used to adhere to best practice at that institution. In terms of the progression across the studies from a theoretical perspective, measures were selected based on previous findings and on account of differences between the populations. Measures that did not significantly change in Study 1, such as spiritual well-being and experiences with injustice were not used in futures studies, and measures that did not significantly change for Study 2, such as positive and negative affect, were not used in Study 3.

Measures that did improve in earlier studies, such as self-compassion (SCS-SF), pain catastrophizing, and anxiety (HADS), were used in future studies. Despite similarities of experience across the two populations such as pain, lengthy hospital stays, and disability, there are experiences that are unique to each group and these differences also informed the selection of questionnaires. For example, individuals with traumatic SCI experience one single episode traumatic accident, and so post-traumatic growth was considered to be an appropriate measure for this population. On the other hand, experiences with injustice were more appropriate for individuals who have experienced repeated economic and health care marginalization over time. Therefore, both practical factors, such as interdisciplinary relationships and existing evaluation practices, and theoretical factors, such as the relevance of a specific measure for a given population and a natural evolution of knowledge, informed the selection of measures across the studies.

A final shortcoming of these projects was the importance placed on significant results as indicated by improvements in the quantitative measures at the $p < 0.05$ level, rather than on effect sizes. There is increasing recognition in the biomedical sciences for the utility of effect sizes in hypothesis testing over categorical *p* value reporting. This has resulted in a shift in priority to using effect size and confidence interval reporting for clinical significance, which provides information about the magnitude, direction, reliability and precision of the results (Vila et al., 2017). Reporting of effect sizes has been recommended for increased comparability across studies, situating results in the context of other research, and seamless reporting in meta-analyses (Nakagawa & Cuthill, 2007). On account of the emerging value of effect size reporting, guidelines have been developed for calculating, reporting, and interpreting both standardized and unstandardized effect sizes (Pek & Flora, 2017). These authors recognize the usefulness of

standardized effect sizes in comparing results across studies, but they also point to the less well known benefit of unstandardized effect sizes for capturing idiosyncrasies of data and present a number of practical and specific recommendations for researchers. For example, it's recommended that specificity of confidence intervals should evolve as a field matures; research in an emerging field is entitled to larger confidence intervals, while it's expected that more established fields of research should use narrower intervals for increased estimate precision (Pek & Flora, 2017).

Study 1 reported effect sizes (small: 0.29 - 0.35) for measures with significant improvements at the 0.5 level; however, these findings were not a focus of the results and were not elaborated on in the discussion. Reports of the effect sizes for the other measures may have provided clinical utility and created an opportunity to compare this study with other trials evaluating yoga for individuals with chronic disease. This study also presented information on the number of participants who met clinically relevant cut off scores for anxiety and depression, but these findings were also not highlighted in the discussion. In a similar vein, effect size reporting may have illustrated important information in Study 2, in which there were no significant quantitative results and in Study 3, in which there were a number of significant results. The reporting of effect sizes either independently or alongside more tradition *p* value reporting is recommended for future research.

Section 3: Future Directions and Conclusions

Future Research.

It is hoped that these findings will be considered in the design and implementation of future yoga research projects for individuals with CCDD or SCI and associated pain, limited

mobility, functional disability, and psychological sequelae. The emerging field of yoga research for individuals with severe and impairing injury or disability would benefit from larger trials to further explore the impact of yoga interventions on health and well-being. Future research trials should use a randomized, controlled trial study design with appropriate control or comparison conditions (e.g., wait-list, exercise, relaxation, or educational). Evaluating control conditions that employ mind-body interventions such as Tai Chi or Qi Gong may prove informative in differentiating these Eastern-based practices with regards to therapeutic utility. Tai Chi has been evaluated in an SCI population; pre-post intervention improvements in strength and balance were demonstrated in a study evaluating a 12 week, twice weekly tai chi intervention for persons with SCI when compared to an active control involving education and social activities (Tsang et al., 2015).

It has been recommended that individual yoga therapy programs may provide important therapeutic gains that are not possible in group classes (Khalsa et al., 2016a) and there is one study that documents the physical (flexibility, strength, balance) improvements observed in a case study evaluating yoga therapy for SCI (Moriello et al., 2014). Given the severely impairing nature of this condition, it may be that individuals with SCI would benefit from a dualistic approach in which they receive both highly tailored individual yoga therapy, in combination with group classes. There have been specific recommendations for various chronic conditions (e.g., arthritis, cardiovascular disease, joint replacement) and spinal conditions (e.g., herniation, hyperkyphosis, scoliosis, stenosis, spondylolisthesis) in terms of types of practices (e.g., breathing practices, meditation) and classifications of indicated postures (e.g., backbends, twists, forward extensions) (McCall, Blashki, Tiwari, Kepner, & Fishman, 2016). These recommendations should be considered in tailoring yoga therapy or yoga programs for

conditions with musculoskeletal vulnerabilities. The use of high quality, mixed methods designs that employ both qualitative and quantitative components recommended for capturing a complete picture of subjective, patient-reported outcomes and objective measures (Khalsa et al., 2016a).

Given that levels of mindfulness and self-compassion increased in two of these studies, and have been shown to be mediating variables of improvements in psychological experience in other yoga research trials, future research should evaluate the mediating role of these constructs for individuals with SCI. By targeting self-compassion in the content and philosophy portions of the yoga interventions, this construct may be more impactful on mediating psychological change. It has been proposed that mindfulness may provide therapeutic gains by increasing compassion and psychological flexibility and by decreasing the propensity for rumination (Chiesa et al., 2014) and so modelling of the relationships of these variables in the context of a yoga intervention is warranted. Trials that seek to further illuminate processes that underlie therapeutic gains may wish to use measures of self-regulation, self-compassion, stress, and positive affect combined with neuro-endocrine-inflammatory markers of physiological status (Riley & Park, 2015; Schmalzl et al., 2016). Evaluation of how these variables interact with pain-related constructs in the fear-avoidance model of chronic pain (e.g., chronic pain acceptance, pain-related disability, fear of pain, pain anxiety, pain self-efficacy) may be warranted to better understand the converging impacts that result in distress and disability and with the end purpose of improve health and well-being.

Although the three studies in the present dissertation used specialized yoga interventions in terms of selecting appropriate components, they were not specialized in categorizing participants into sub-groups. The participants with CCDD in Study 1 had a range of medical ailments and limitations, and so the physical postures involved general, rather than refined

movements, with the purpose of increasing accessibility. The pilot RCT tailored the yoga intervention to individuals with SCI who have limited mobility and instability of the musculoskeletal system. However, it was not tailored to the degree of injury and therefore did not differentiate between individuals with varying levels of injury type. Every SCI is unique and is characterized by level of completeness or level of injury, and exact tailoring to the degree of mobility or sensation is ideal. Future studies should tailor yoga programs to a greater extent, especially for individuals with tetraplegia or complete SCI who may need greater one-on-one care and modification of *āsanas*. The use of props in Study 3 was limited to Iyengar yoga blankets for spinal and postural support. Other traditional props, such as straps and bolsters, may assist participants in achieving musculoskeletal control or action in specific postures, thereby increasing the potential impact of the *āsanas*. Designing yoga interventions for severely disabled populations involves a critical balance between accessibility and refined action. In essence, the task of the designers/instructors is to find new possibilities in terms of mental awareness or physical motor control within the concrete limitations of paralysis or illness-associated pain and fatigue.

In order to create meaningful yoga interventions for individuals with tetraplegia, it is recommended that larger trials use a multi-wave design rather than larger class sizes, so that individualized care is possible. It may also be beneficial to have a high teacher-to-student ratio, to ensure that participants maximize on obtaining benefits from the degree of movement that is accessible for each body. As mentioned above, possibly combining yoga therapy with yoga classes may enable participants to maximize physical gains while benefiting from the encouragement and support inherent in social activities. Previous research has documented that participation in an Iyengar yoga intervention resulted in reduced pain medication consumption

for individuals with chronic low back pain, (Williams et al., 2009) and so evaluation of the impact of yoga on pain medication consumption for individuals with SCI may provide important information regarding alternate pain management strategies.

The application of mind-body interventions in North America has been largely focused on symptom-reduction, but Eastern models consider more nuanced concepts, such as the "subtle body" in the pursuit of health (Bechsgaard, 2013; Farb et al., 2015; Loizzo, 2016). Practices involving breath work and interoceptive integration of multiple body systems have been proposed to increase an overall sense of self and wellness (Farb et al., 2015), which may provide direct benefits to individuals with CCDD or SCI who experience a fragmented or disrupted sense of self, due to multiple health issues, psychological concerns, polypharmacy, and social isolation. A recent book integrating ancient principles with scientific yoga research highlights the relationships between the breath, meditative dimensions of human life, and the potential for health; "Observation of the breath calms emotional reactivity, heightens awareness of the energetic dimensions of human life, and awakens the witnessing mind." (Sovik & Bhavanani, 2016). In addition to immediate gains in well-being through the practice of breathing exercises and deep relaxation, awareness of slight changes to internal states may also yield benefits for health assessment and behavioural change. With increasing awareness of disruptions or imbalances in internal homeostasis of vital bodily systems (endocrine, inflammatory, musculoskeletal), changes can be implemented to begin a remediation process and with a goal of preventing health from worsening (Khalsa et al., 2016b). Further evaluation of subtle practices and interoception in yoga research trials using standardized protocols or yoga therapy may contribute to the evolving literature on mechanisms of yoga and highlight a preventative strategy for chronic disease.

In communities where public and accessible transportation is not possible, such as rural and remote settings, the use of electronic resources or video conferencing for service provision may be useful and increase access for individuals who encounter physical limitations to attending institutionally-based yoga interventions. However, it is recommended that potential participants/students of yoga only be granted access to such e-resources after a comprehensive assessment is conducted by a yoga instructor, to determine appropriate and safe practice guidelines. A pitfall of the yoga arena is the accreditation of instructors on minimal number of apprenticeship hours or poor quality of training, and so instructors should be selected who have high levels of expertise and experience in working with individuals with musculoskeletal disability. Finally, interventions should be evaluated at follow-up intervals to determine the lasting effect of yoga on psychological experience.

Conclusions.

The results of this dissertation indicate that individuals experiencing chronic and complex health impacts or injury that are accompanied by pain and debilitating disability benefit from specialized yoga interventions. The results from Study 1 suggest that an eight-week specialized yoga program helps to reduce anxiety and pain magnification cognitions and to increase self-compassion. This is the first report of self-compassion mediated changes in psychological symptoms in the context of a yoga intervention. Although the results from Study 2 did not yield quantitative improvements in pain and psychological experience, the results from Study 3 demonstrated improvements in depressive symptoms and increased self-compassion in individuals with SCI, when compared to a wait-list control group. The results also suggest that a

yoga program may result in increases in mindfulness from pre- to post-intervention, with an increased capacity to observe and not react to immediate physical and emotional experience.

When taught and practiced appropriately, yoga is a safe, accessible and supportive mind-body practice that may attenuate or offer protection from some of the devastating and life-altering consequences impacts of CCDD and SCI. These studies provide evidence for yoga as an auxiliary care service that may be amenable to institutions that are in the process of evolving from single-disease treatment frameworks and that are seeking to assimilate programs and services that can address multiple, intersecting health concerns. The use of larger scale RCTs with a more intensive yoga intervention design (e.g., two or more classes a week for 10-12 weeks) is recommended to further explore the relationship between pain, psychological experience and mindfulness or spiritual constructs in individuals who experience complex chronic disease, injury, and disability. Future interventions should aim to be highly adaptable to the various needs of individuals with severe mobility restrictions and use specialized props to promote depth of awareness in the poses. The field of yoga research would benefit from comparative effectiveness trials to contrast various behavioural approaches (e.g., Tai Chi, Yoga). As well, better understanding the impact of yoga on disability-related factors, such as activities of daily living or independence is warranted. It may also serve participants to supply materials for continued practice, such as pamphlets or audio files, to assist in bridging concepts learned in class into daily life. By providing evidenced-based research in the field of yoga and pain research and it is hoped that clinical and tertiary care settings may adopt yoga interventions for CCDD and SCI populations.

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Appendix A: Yoga for Chronic Complex Disease and Disability: Study 1 Materials and Measures

List of Yoga Postures Used in the Yoga Program

Quantitative Questionnaires

Demographic Information, Health History and Current Health Status

Qualitative Questions

Recruitment Materials

Consent Form

REB Approvals from Bridgepoint Health and York University HPRC

Appendix A: List of Yoga Postures Used in the Yoga Program

Postures:

- Shoulder opener variations with different degrees of difficulty and positioning of the arms
- Padanguilasana with alternating finger positioning
- Neck stretch (forward and lateral extensions)
- Bitilasana variation
- Mārjāryāsana variation
- Thoracic extension variation
- Bharavājāsana variation (seated twist)
- Ūrdhva Hastāsana and related variations
- Ūrdhva namaskarāsana
- Śavasana

N.B. Multiple repetitions were completed for each posture

Specific Instructions:

- Noticing differences between right and left sides of the body
- Noticing changes in vitality in the body through practice
- Breath-movement coordination (in-breath: upright quality, out-breath: expansive quality)
- Contact the innermost light in oneself
- Balance between stability and softness in movement (strength but not overdoing)
- Sense of joy through ‘touch-and-go’ method (arm postures)
- Releasing tension/pain/discomfort with exhale

Appendix A: Quantitative Questionnaires

Brief Pain Inventory-Short Form – BPI-SF (Selected Items, one item rephrased)

Pain Catastrophizing Scale – PCS

Perceived Stress Scale-Short Form – PSS-SF

Hospital Anxiety and Depression Scale-Anxiety, -Depression – HADS-A, -D

Injustice Experiences Questionnaire – IEQ (one term rephrased)

Five Factor Mindfulness Questionnaire-Short Form – FFMQ-SF

Self-Compassion Scale-Short Form – SCS-SF

Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being – FACIT-SpWB

BPI-SF, selected items

3) Please rate your pain by circling the one number that best describes your pain at its worst in the last 24 hours.

No pain	0	1	2	3	4	5	6	7	8	9	10	Pain as bad as you can imagine

4) Please rate your pain by circling the one number that best describes your pain at its least in the last 24 hours.

No pain	0	1	2	3	4	5	6	7	8	9	10	Pain as bad as you can imagine

5) Please rate your pain by circling the one number that best describes your pain on the average.

No pain	0	1	2	3	4	5	6	7	8	9	10	Pain as bad as you can imagine

6) Please rate your pain by circling the one number that best describes your pain right now.

No pain	0	1	2	3	4	5	6	7	8	9	10	Pain as bad as you can imagine

9) Circle the one number that describes how, during the past 24 hours, pain has interfered with your:

a) General activity

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

b) Mood

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

c) Walking ability

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

d) Normal Work (includes daily tasks in the hospital, such as making one's bed)

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

e) Relations with other people

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

f) Sleep

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

g) Enjoyment of life

Does not interfere	0	1	2	3	4	5	6	7	8	9	10	Completely interferes

PCS

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0 – not at all

1 – to a slight degree

2 – to a moderate degree

3 – to a great degree

4 – all the time

When I'm in pain …

1. _____ I worry all the time about whether the pain will end.
2. _____ I feel I can't go on.
3. _____ It's terrible and I think it's never going to get any better.
4. _____ It's awful and I feel that it overwhelms me.
5. _____ I feel I can't stand it anymore.
6. _____ I become afraid that the pain will get worse.
7. _____ I keep thinking of other painful events.
8. _____ I anxiously want the pain to go away.
9. _____ I can't seem to keep it out of my mind.
10. _____ I keep thinking about how much it hurts.
11. _____ I keep thinking about how badly I want the pain to stop.
12. _____ There's nothing I can do to reduce the intensity of the pain.
13. _____ I wonder whether something serious may happen.

PSS-10 Items

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?..... 0 1 2 3 4

2. In the last month, how often have you felt that you were unable to control the important things in your life? 0 1 2 3 4

3. In the last month, how often have you felt nervous and "stressed"? 0 1 2 3 4

4. In the last month, how often have you felt confident about your ability to handle your personal problems? 0 1 2 3 4

5. In the last month, how often have you felt that things were going your way?.....0 1 2 3 4

6. In the last month, how often have you found that you could not cope with all the things that you had to do? 0 1 2 3 4

7. In the last month, how often have you been able to control irritations in your life?.....0 1 2 3 4

8. In the last month, how often have you felt that you were on top of things?....0 1 2 3 4

9. In the last month, how often have you been angered because of things that were outside of your control?..... 0 1 2 3 4

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? 0 1 2 3 4

Hospital Anxiety and Depression Scale (HADS)

Health care professionals are aware that emotions play an important part in most illnesses. If your health care professional knows about these feelings he or she will be able to help you more. **Read each item below and place a check (✓) in the box beside the reply which comes closest to how you have been feeling in the past week.**

1. I feel tense or "wound up"

- ☐ Most of the time
- ☐ A lot of time
- ☐ From time to time
- ☐ Not at all

2. I still enjoy the things I used to enjoy

- ☐ Definitely as much
- ☐ Not quite so much
- ☐ Only a little
- ☐ Hardly at all

3. I get sort of frightened feeling as if something awful is about to happen

- ☐ Very definitely and quite badly
- ☐ Yes, but not to badly
- ☐ A little, but it doesn't worry me
- ☐ Not at all

4. I can laugh and see the funny side of things

- ☐ As much as I always could
- ☐ Not quite so much now
- ☐ Definitely not so much now
- ☐ Not at all

5. Worrying thoughts go through my mind

- ☐ A great deal of the time
- ☐ A lot of the time
- ☐ Not too often
- ☐ Very little

6. I feel cheerful

- ☐ Never
- ☐ Not often
- ☐ Sometimes
- ☐ Most of the time

7. I can sit at ease and feel relaxed

- ☐ Definitely
- ☐ Usually
- ☐ Not often
- ☐ Not at all

8. I feel as if I am slowed down

- ☐ Nearly all the time
- ☐ Very often
- ☐ Sometimes
- ☐ Not at all

9. I get a sort of frightened feeling like "butterflies" in the stomach

- ☐ Not at all
- ☐ Occasionally
- ☐ Quite often
- ☐ Very often

10. I have lost interest in my appearance

- ☐ Definitely
- ☐ I don't take as much care as I should
- ☐ I may not take quite much care
- ☐ I take just as much care as ever

11. I feel restless as if I have to be on the move

- ☐ Very much indeed
- ☐ Quite a lot
- ☐ Not very much
- ☐ Not at all

12. I look forward with enjoyment to things

- ☐ As much as I ever did
- ☐ Rather less than I used to
- ☐ Definitely less than I used to
- ☐ Hardly at all

13. I get sudden feeling of panic

- ☐ Very often indeed
- ☐ Quite often
- ☐ Not very often
- ☐ Not at all

14. I can enjoy a good book or radio or television program

- ☐ Often
- ☐ Sometimes
- ☐ Not often
- ☐ Very seldom

IEQ

When injuries happen, they can have profound effects on our lives. This scale was designed to assess how your medical condition/injury has affected your life. Listed below are twelve statements describing different thoughts and feelings that you may experience when you think about your injury. Using the following scale, please indicate how frequently you experience these thoughts and feelings when you think about your injury.

0 – never 1 – rarely 2 – sometimes 3 – often 4 – all the time

1☐ Most people don't understand how severe my condition is.

2☐ My life will never be the same.

3☐ I am suffering because of someone else's negligence.

4☐ No one should have to live this way.

5☐ I just want to have my life back.

6☐ I feel that this has affected me in a permanent way.

7☐ It all seems so unfair.

8☐ I worry that my condition is not being taken seriously.

9☐ Nothing will ever make up for all that I have gone through.

10☐ I feel as if I have been robbed of something very precious.

11☐ I am troubled by fears that I may never achieve my dreams.

12☐ I can't believe this has happened to me.

ffmq-sf

Below is a collection of statements about your everyday experience. Using the 1–5 scale below, please indicate, in the box to the right of each statement, how frequently or infrequently you have had each experience in the last month (or other agreed time period). Please answer according to what really reflects your experience rather than what you think your experience should be.

never or very rarely true	***not often true***	***sometimes true sometimes not true***	***often true***	***very often or always true***
1	***2***	***3***	***4***	***5***

1	I'm good at finding the words to describe my feelings	
2	I can easily put my beliefs, opinions, and expectations into words	
3	I watch my feelings without getting carried away by them	
4	I tell myself that I shouldn't be feeling the way I'm feeling	
5	it's hard for me to find the words to describe what I'm thinking	
6	I pay attention to physical experiences, such as the wind in my hair or sun on my face	
7	I make judgments about whether my thoughts are good or bad.	
8	I find it difficult to stay focused on what's happening in the present moment	
9	when I have distressing thoughts or images, I don't let myself be carried away by them	
10	generally, I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing	
11	when I feel something in my body, it's hard for me to find the right words to describe it	
12	it seems I am "running on automatic" without much awareness of what I'm doing	
13	when I have distressing thoughts or images, I feel calm soon after	

14	I tell myself I shouldn't be thinking the way I'm thinking	
15	I notice the smells and aromas of things	
16	even when I'm feeling terribly upset, I can find a way to put it into words	
17	I rush through activities without being really attentive to them	
18	usually when I have distressing thoughts or images I can just notice them without reacting	
19	I think some of my emotions are bad or inappropriate and I shouldn't feel them	
20	I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow	
21	when I have distressing thoughts or images, I just notice them and let them go	
22	I do jobs or tasks automatically without being aware of what I'm doing	
23	I find myself doing things without paying attention	
24	I disapprove of myself when I have illogical ideas	

HOW I TYPICALLY ACT TOWARDS MYSELF IN DIFFICULT TIMES

Please read each statement carefully before answering. To the left of each item, indicate how often you behave in the stated manner, using the following scale:

Almost never				**Almost always**
1	**2**	**3**	**4**	**5**

_____1. When I fail at something important to me I become consumed by feelings of inadequacy.

_____2. I try to be understanding and patient towards those aspects of my personality I don't like.

_____3. When something painful happens I try to take a balanced view of the situation.

_____4. When I'm feeling down, I tend to feel like most other people are probably happier than I am.

_____5. I try to see my failings as part of the human condition.

_____6. When I'm going through a very hard time, I give myself the caring and tenderness I need.

_____7. When something upsets me I try to keep my emotions in balance.

_____8. When I fail at something that's important to me, I tend to feel alone in my failure

_____9. When I'm feeling down I tend to obsess and fixate on everything that's wrong.

_____10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.

_____11. I'm disapproving and judgmental about my own flaws and inadequacies.

_____12. I'm intolerant and impatient towards those aspects of my personality I don't like.

FACIT-Sp-12

Below is a list of statements that other people with your illness have said are important. Please circle or mark one number per line to indicate your response as it applies to the past 7 days.

Not at all	A little bit	Somewhat	Quite a bit	Very much
0	1	2	3	4

1. I feel peaceful 0 1 2 3 4

2. I have a reason for living 0 1 2 3 4

3. My life has been productive 0 1 2 3 4

4. I have trouble feeling peace of mind 0 1 2 3 4

5. I feel a sense of purpose in my life..... 0 1 2 3 4

6. I am able to reach down deep into myself for comfort 0 1 2 3 4

7. I feel a sense of harmony within myself 0 1 2 3 4

8. My life lacks meaning and purpose..... 0 1 2 3 4

9. I find comfort in my faith or spiritual beliefs 0 1 2 3 4

10. I find strength in my faith or spiritual beliefs..... 0 1 2 3 4

11. My illness has strengthened my faith or spiritual beliefs 0 1 2 3 4

12. I know that whatever happens with my illness, things will be okay 0 1 2 3 4

Appendix A: Demographic Information, Health History and Current Health Status

Part I. Demographic Information

1. Participant ID#: _____

2. Year of Birth: _____

3. Current age: _____

4. Height: _____

5. Weight: _____

6. Ethnic Background (check as many as apply to you):

1. ☐ African-Canadian
2. ☐ South Asian (e.g., India, Pakistan, Sri Lanka)
3. ☐ East Asian (e.g., Hong Kong, China, Vietnam, Korea)
4. ☐ Middle Eastern or North African (e.g., Iran, Israel, Egypt, Morocco)
5. ☐ Caucasian
6. ☐ Hispanic
7. ☐ Aboriginal
8. ☐ Other (please specify) _____

In the above question, a list of ethnic backgrounds was provided. However, this list may or may not specify how you identify. Regardless of your answer to the previous question, how do you identify your ethnic background (s)?

Ethnically, I identify as: _____

7) What is your first language? _____

8) What socioeconomic class range do you identify with?

1. ☐ $<25 000.00
2. ☐ $25 000.00 - $39 000.00
3. ☐ $40 000.00 - $59 000.00
4. ☐ $60 000.00 - $79 000.00
5. ☐ $80 000.00 - $100 000.00
6. ☐ >$100 000.00

9) What is your occupation? _____
What is your employment status? _____

10) Highest level of school completed:

☐ Grade school ☐ High School ☐ College/University ☐ Postgraduate

11) Have you experienced any major life events in the past year (death of a family member, loss of a job, a traumatic accident or event, or a change in residence, etc)? Y ☐ N ☐
If yes, what was it?_____

Part II. Health History and Current Health Status

1. What is your current primary health concern for being at Bridgepoint Hospital?
   _____
   _____

   a. Do you have a diagnosis for this health concern? ☐ Yes ☐ N
   b. For how long have you had the diagnosis?_____
   c. Are you taking medication for this condition? ☐ Yes ☐ N
   d. If yes, what medication are you taking for this condition?
   _____
   _____

2. Do you have any diagnoses for other physical health conditions? ☐ Yes ☐ N

   a. If Yes, list the condition(s):
   _____
   _____
   b. For how long have you had the diagnosis(es)?_____
   c. Are you taking medication for this/these condition(s)? ☐ Yes ☐ N
   d. If yes, what medication are you taking (please write the health condition beside the medication)?
   _____
   _____

3. Do you have any formal psychological or psychiatric diagnoses (e.g. Depression, Anxiety, Post-Traumatic Stress Disorder, etc.)? ☐ Yes ☐ No

   a. If Yes, list diagnosis or type of psychological condition:
   _____
   _____
   b. For how long have you had the diagnosis? _____
   c. Are you taking medication for this condition? ☐ Yes ☐ N
   d. If yes, what medication are you taking?_____

4. Do you have any ongoing pain problems (e.g. back pain, arthritis, migraines, intestinal pain, etc.)? ☐ Yes ☐ No

a. If Yes, list diagnosis or type of pain and location

_____

_____

b. For how long have you had the pain? _____

5. Have you been diagnosed with any other health conditions in the past that you no longer experience symptoms for? ☐ Yes ☐ No

a. If Yes, list diagnosis or type of condition and the duration in months/years:

_____

6. Have you taken medications or received treatments other than what you have listed above?
Y ☐ N ☐

If yes, please fill in the chart below by specifying the name of medications and other treatments you have used.

Name of treatment	
Type	Enter names below
Pharmacological medications e.g., Aspirin, Tylenol, Naproxen, Advil, Motrin, Tylenol #3 or others	1
	2
	3
	4
Natural health products e.g., vitamins, mineral supplements, dietary supplements, herbs, marijuana	1
	2
	3
	4
Physical approaches e.g., acupuncture, physiotherapy, massage, exercise, acupressure	1
	2
	3
	4
Psychological approaches e.g., psychotherapy, hypnosis, relaxation, distraction techniques, talking to a religious/spiritual authority, prayer, meditation, breathing techniques	1
	2
	3
	4

Appendix A: Qualitative Questions

Expectations for the Yoga Program

We would like to know what you expect to gain from taking part in the program. Please describe any personal changes that you anticipate occurring over the following 8 weeks, as a result of taking part in this program. If you don't expect any changes, please write "no expected changes". If you have difficulties holding a pen or writing, please find a staff member to help you fill this out.

Experiences of the Yoga Program

1) What were your experiences of the yoga program?

2) Did you notice any benefits from the yoga program and if so, what were they?

3) Did you notice any negative effects of the yoga program and if so, what were they?

4) Did your understanding or perception of your health condition(s) change over the course of the yoga program, and if so, how?

5) Since you participated in the yoga program, did your perceptions of your body change, and if so, how?

6) Did you experience any shifts in how you think about, understand or experience your sense of self throughout the yoga program, and if so, what were they?

7) Since you participated in the yoga program, have there been any changes in your perspective about your future?

8) Since you participated in the yoga program, has your daily life changed? If so, how?

9) Have there been any shifts in how you understand or think about your purpose in life?

10) We ask that you take a look at the expectations you wrote down before the yoga program began. Would you say that your expectations were fulfilled? If so, how? If not, what would have been necessary in the program for your expectations to be fulfilled?

11) What other things would you have liked to have in the program?

Appendix A: Recruitment Materials

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Bridgepoint Collaboratory for Research and Innovation
14 St. Matthews Road
Toronto, ON M4M 2B5 Canada
bridgepointhealth.ca

BRIDGEPOINT
active healthcare

University of Toronto Affiliated Hospital

YOGA STUDY

We are looking for volunteers to participate in a specialized 8-week yoga program at Bridgepoint Active Healthcare. We are looking for individuals who are undergoing medical rehabilitation and who have had little or no experience doing yoga. Participation involves attending one yoga class per week for 8 weeks, doing the yoga practice twice a week for homework and filling out some questionnaires before, mid-way through and after the yoga program.

The yoga classes will be specialized for individuals who are using wheel chairs and so all poses will be done in a seated position. However, it is not necessary to be in a wheel chair to participate. Each Hatha yoga class will be 60 minutes long, and will consist of upper body yoga postures, breathing techniques and relaxation practices. Hatha yoga is based on the development of mind-body unity and balance, and has been selected as an appropriate form of yoga for individuals with complex conditions since it is gentle and can be easily modified to accommodate for mobility difficulties. It focuses on more breathing techniques and awareness building practices than strength building, though there is also an emphasis on movement.

If you are interested, please contact Jennifer Ridgeway at [redacted]. You will be invited to an information session where you will have a chance to ask any questions. Should you decide to participate, you will fill out an informed consent form and questionnaires at this session.

Appendix A: Informed Consent Form

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RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM

Title: Transforming the Lived Experience of Individuals Receiving Medical Reconditioning through a Yoga Program Provided in an In-Patient Setting: A Collaborative and Tailored Approach

Principal Investigator: Kathryn Curtis (York University)

Co-Investigators: Dr. Kerry Kuluski (Bridgepoint), Jennifer Ridgway (Bridgepoint), Dr. Joel Katz (York University)

Introduction and Purpose of the Study

People who have more than one health problem and people who are in hospital for rehabilitation often have pain and they may worry about many things. They may have a hard time getting around and doing every day things. The way they get along with their family may also change. Yoga has been shown to make many of these problems better.

The researchers would like to talk to you about how you may feel stressed, down or worried and also about your spiritual beliefs, while you participate in a yoga program at the hospital. This research is being done as part of Kathryn Curtis's PhD work.

Study Procedures

If you agree to participate in the study, you will be asked to:

1) Take one hatha yoga class each week for eight weeks. Hatha yoga uses physical poses, relaxation exercises, and breathing techniques. You will also be given a 30 minute recording of a guided practice and will be asked to practice on your own twice a week by listening to the recording. There will be approximately 15 people in the class.

2) You will also be asked to fill out forms before the yoga program, in the middle of the yoga program and after the yoga program. These forms will be asking about your feelings and thoughts in relation to everyday situations and also about your experiences with the yoga program.

Risks and Discomforts:

It is possible that when you start doing yoga for the first time, any pain you have may get worse and your muscles might be a bit sore. This is usually because your body is not used to doing exercise or moving in certain ways. It is also possible that some of the questions we ask may make you feel uncomfortable, and you do not need to answer those questions.

Benefits of the Research: By taking the yoga classes and filling out the forms, you will be helping the researchers to understand if yoga may be helpful when used with regular rehabilitation.

Payment: This program is free for you to take. You will not receive any payment for participating in this study.

Voluntary Participation: Your participation in the study is completely voluntary and you may choose to stop taking part at any time. Your decision not to participate will not affect your relationships with staff or researchers at the hospital or York University either now or in the future.

Withdrawal from the Study: You can stop participating in the study at any time, for any reason. Your decision to stop participating, or to not answer particular questions, will not affect your relationship with the staff at the hospital, the researchers, York University, or anyone else involved in this project. If you decide to stop participating, and you do not want the researchers to use the information collected, you may ask them to destroy the data and they will do so right away. You have the rights to any of the data collected.

Confidentiality: The information you supply on the forms will be held in confidence and will be safely stored in a locked cabinet at York University for up to seven years, after which it will be destroyed. All data will be stored without any personal information and will use a number code, meaning that the stored records will not contain any information that could identify you. Electronic copies of the data will be protected by password. Only researchers directly involved in the study will be able to look at this information. Confidentiality will be provided to the fullest extent possible by law. The findings of this study may be presented at research conferences or published in journals, but no identifying information will be used. The researchers may look in your health record at the hospital to find out any important conditions you have, medicine you have used or programs you have taken at the hospital. By signing this consent form you allow to them to look at your health record..

Questions About the Research? If you have questions about the research in general or about your role in the study, please feel free to contact Kathryn Curtis, or Dr. Joel Katz either by telephone at [redacted] or by e-mail [redacted]. You can also reach Dr. Kerry Kuluski or Jennifer Ridgway by phone at [redacted] or by email [redacted]).

This research has been reviewed and approved by the Joint Bridgepoint Health – West Park HealthCare Centre –Toronto Central Community Care Access Centre (CCAC) – Toronto Grace Health Centre Research Ethics Board (JREB) and the Human Participants Review Sub-

Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines. If you have any questions about this process, or about your rights as a participant in the study, please contact the Sr. Manager & Policy Advisor for the Office of Research Ethics, 5th Floor, York Research Tower, York University (telephone [redacted] or e-mail [redacted]. You may also contact the Chair of the Joint Research Ethics Board, Dr. Ronald Heslegrave at [redacted].

Legal Rights and Signatures:

I, _____, consent to participate in the study "Transforming the Lived Experience of Individuals Receiving Medical Reconditioning through a Yoga Program Provided in an In-Patient Setting: A Collaborative and Tailored Approach." conducted by Kathryn Curtis, Dr. Kerry Kuluski, Jennifer Ridgway, and Dr. Joel Katz. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

_____	_____	_____
Participant Name	Participant Signature	Date (dd/mm/year)
_____	_____	_____
Name of person obtaining consent	Signature of person obtaining consent	Date (dd/mm/year)
_____	_____	_____
Name of witness	Signature of witness	Date (dd/mm/year)

Appendix A: REB Approvals from Bridgepoint Health and York University HPRC

Notification of JREB Approval

September 18, 2014

Ms. Kathryn Curtis
Phd Candidate, Clinical Psychology
York University
4700 Keele Street
297 Behavioural Sciences Building
Toronto, Ontario M3J 1P3

Study Title	***Transforming the Lived Experience of Individuals Receiving Medical Reconditioning through a Hatha Yoga Program Provided in an In-Patient Setting: A Collaborative and Tailored Approach***
JREB Number	14-020-BP
JREB Review Type	Full Board
JREB Approval Date	September 18, 2014
JREB Expiry Date	September 18, 2015
Documents Approved	JREB Application Form September 10, 2014 Study Protocol September 10, 2014 Appendix 1-5 September 10, 2014 Appendix 6 Informed Consent September 17, 2014
Documents Acknowledged	Covering letter September 10, 2014 Covering email dated September 17, 2014

Dear Ms. Curtis:

I am writing to confirm that your protocol entitled, ***"Transforming the Lived Experience of Individuals Receiving Medical Reconditioning through a Hatha Yoga Program Provided in an In-Patient Setting: A Collaborative and Tailored Approach"*** has received *full ethical approval* and you may proceed with data collection.

If, during the course of the research, there are any serious adverse events, any confidentiality concerns, changes in the approved protocol or consent form, or any new information that must be considered with respect to the project, these should be brought to the immediate attention of the JREB. In the event of a privacy breach, you are responsible for reporting the breach to the JREB (in accordance with Ontario health privacy legislation – Personal Health Information Protection Act, 2004). Additionally, the JREB requires reports of inappropriate/unauthorized use of the information.

The Joint Bridgepoint Active Healthcare-West Park Healthcare Centre-Toronto Central Community Care Access Centre-The Salvation Army Toronto Grace Health Centre Research Ethics Board (JREB) operates in compliance with the Tri-Council Policy

Statement, ICH/GCP Guidelines, the Ontario Personal Health Information Protection Act, and Part C, Division 5 of the Food and Drug Regulations of Health Canada.

Should you wish to make any further changes or revisions to any aspect or portion of the approved project, they must be submitted for consideration to the board prior to amending the protocol. Address any proposed changes to: Joint Research Ethics Board, c/o Cherry Pond at [redacted] or The Salvation Army Toronto Grace Health Centre, 47 Austin Terrace, Toronto, ON, M5J 1Y8.

Finally, all research conducted at Bridgepoint Active Healthcare, West Park Healthcare Centre, Toronto Central Community Care Access Centre or The Salvation Army Toronto Grace Health Centre is subject to ongoing monitoring that includes the submission, in writing, of an **annual** status report of project activities to the board. If the study is expected to continue beyond the expiry date, you are responsible for ensuring the study receives re-approval. The JREB must be notified of the completion or termination of this study and a final report provided. As the Principal Investigator, you are responsible for the ethical conduct of this study.

Best wishes for the progress of this work.

Yours very truly,

Ron Heslegrave, PhD
Chair, Joint Bridgepoint Active Healthcare/West Park Healthcare Centre/Toronto Central CCAC/The Salvation Army Toronto Grace Health Centre Research Ethics Board

Notification of JREB Amendments Approval

October 17, 2014

Ms. Kathryn Curtis
York University
Behavioural Sciences Building
4700 Keele Street
Toronto, Ontario M3J 1P3

Study Title	***Transforming the Lived Experience of Individuals Receiving Medical Reconditioning through a Hatha Yoga Program Provided in an In-Patient Setting: A Collaborative and Tailored Approach***
JREB Number	14-020-BP
REB Review Type	Full Board
JREB Amendment Approval Date	October 16, 2014
JREB Approval Date	September 18, 2014
JREB Expiry Date	September 17, 2015
Documents Approved	JREB Application Amended Study Protocol Amended
Documents Acknowledged	Covering letter dated October 16, 2014

Dear Ms. Curtis:

I am writing to confirm that your protocol entitled, *"*Transforming the Lived Experience of Individuals Receiving Medical Reconditioning through a Hatha Yoga Program Provided in an In-Patient Setting: A Collaborative and Tailored Approach*"* has received full consent and approval for the requested amendments listed below:

(1) To include patients from the 3rd, 4th, 6th, and 9th floors, in addition to the 7th and 8th floors. This change is noted at the bottom of page 3 of the proposal.
(2) Changed the terminology describing the patient population to reflect a more inclusive approach; we have changed the term "medical reconditioning" to "complex care". This change is present in the title of the project and also throughout the REB protocol and proposal, such that in any place where there was the term "medical reconditioning", it now states "complex care". We will highlight that this change is also present in the consent form and the recruitment poster.
(3) It should be noted that the inclusion criteria will not change as the original wording states that the participant simply needs to be an inpatient at Bridgepoint Active Healthcare.

If, during the course of the research, there are any serious adverse events, any confidentiality concerns, changes in the approved protocol or consent form, or any new information that must be considered with respect to the project, these should be brought

to the immediate attention of the JREB. In the event of a privacy breach, you are responsible for reporting the breach to the JREB (in accordance with Ontario health privacy legislation – Personal Health Information Protection Act, 2004). Additionally, the JREB requires reports of inappropriate/unauthorized use of the information. Please be aware that it is JREB policy that research-related activities involving an external party require a research agreement. An 'external party' refers to a corporation other than Bridgepoint Health, West Park Healthcare Centre, Toronto Central CCAC or Toronto Grace Health Centre or an individual who is not Bridgepoint Active Healthcare, West Park Healthcare Centre, Toronto Central CCAC or The Salvation Army Toronto Grace Health Centre personnel. Should a research agreement be required in this case, the study may not begin at Bridgepoint Active Healthcare, West Park Healthcare Centre, Toronto Central CCAC or The Salvation Army Toronto Grace Health Centre until the agreement has been signed by all parties. Should the negotiation process raise concerns, the JREB reserves the right to reconsider its approval.

The Joint Bridgepoint Active Healthcare-West Park Healthcare Centre-Toronto Central CCAC-The Salvation Army Toronto Grace Health Centre Research Ethics Board (JREB) operates in compliance with the Tri-Council Policy Statement, ICH/GCP Guidelines, the Ontario Personal Health Information Protection Act, and Part C, Division 5 of the Food and Drug Regulations of Health Canada. Should you wish to make any further changes or revisions to any aspect or portion of the approved project, they must be submitted for consideration to the board prior to amending the protocol. Address any proposed changes to: Joint Research Ethics Board, c/o [redacted] or Cherry Pond, The Salvation Army Toronto Grace Health Centre, 47 Austin Terrace, Toronto, ON, M5R 1Y8.

Finally, all research conducted at Bridgepoint Active Healthcare, West Park Healthcare Centre, Toronto Central CCAC or The Salvation Army Toronto Grace Health Centre is subject to ongoing monitoring that includes the submission, in writing, of an **annual** status report of project activities to the board. If the study is expected to continue beyond the expiry date, you are responsible for ensuring the study receives re-approval. The JREB must be notified of the completion or termination of this study and a final report provided. As the Principal Investigator, you are responsible for the ethical conduct of this study.

Best wishes for the progress of this work.

Yours very truly,

Ron Heslegrave, PhD
Chair, Joint Bridgepoint Active Healthcare/West Park Healthcare Centre/Toronto Central CCAC/The Salvation Army Toronto Grace Health Centre Research Ethics Board

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Certificate #:	**2014 - 285**
Approval Period:	**10/16/14-10/16/15**

OFFICE OF RESEARCH ETHICS (ORE)
5th Floor, Kaneff Tower

4700 Keele St.
Toronto ON
Canada M3J 1P3
Tel 416 736 5914
Fax 416 736-5512
www.research.yorku.ca

Memo

To: Professor Joel Katz, Psychology, Faculty of Health, [redacted];

From: Alison M. Collins-Mrakas, Sr. Manager and Policy Advisor, Research Ethics
(on behalf of Denise Henriques, Chair, Human Participants Review Committee)

Date: **Thursday, October 16, 2014**

Re: Ethics Approval

Transforming the Lived Experiences of Individuals Receiving Medical Reconditioning through a Hatha Yoga Program in an In-Patient Setting: A Collaborative and Tailored Approach

---

I am writing to inform you that the Human Participants Review Sub-Committee has reviewed and approved the above project.

Should you have any questions, please feel free to contact me at: [redacted] or via email at: [redacted].

Yours sincerely,

Alison M. Collins-Mrakas M.Sc., LLM
Sr. Manager and Policy Advisor,
Office of Research Ethics

RESEARCH ETHICS: PROCEDURES to ENSURE ONGOING COMPLIANCE

Upon receipt of an ethics approval certificate, researchers are reminded that they are required to ensure that the following measures are undertaken so as to ensure on-going compliance with Senate and TCPS ethics guidelines:

1. **RENEWALS:** Research Ethics Approval certificates are subject to annual renewal. **It is the responsibility of researchers to ensure the timely submission of renewals.**
    a. As a courtesy, researchers will be reminded by ORE, in advance of certificate expiry, that the certificate must be renewed. Please note, however, it is the expectation that researchers will submit a renewal application prior to the expiration of ethics certificate(s).
    b. **Failure to renew an ethics approval certificate** (or to notify ORE that no further research involving human participants will be undertaken) **may result in suspension of research cost fund and access to research funds may be suspended/ withheld**.

2. **AMENDMENTS:** Amendments must be reviewed and approved **PRIOR** to undertaking/making the proposed amendments to an approved ethics protocol;

3. **END OF PROJECT**: ORE must be notified when a project is complete;

4. **ADVERSE EVENTS**: Adverse events must be reported to ORE as soon as possible;

5. **POST APPROVAL MONITORING:**
    a. More than minimal risk research may be subject to post approval monitoring as per TCPS guidelines;
    b. A spot sample of minimal risk research may similarly be subject to Post Approval Monitoring as per TCPS guidelines.

FORMS: As per the above, the following forms relating to on-going research ethics compliance are available on the Research website:

a. Renewal
b. Amendment
c. End of Project
d. Adverse Event

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Certificate #:	**2014 - 285**
Amendment Approved:	**10/24/14**
Approval Period:	**10/16/14-10/16/15**

OFFICE OF RESEARCH ETHICS (ORE)
5th Floor, Kaneff Tower

4700 Keele St.
Toronto ON
Canada M3J 1P3
Tel 416 736 5914
Fax 416 736-5512
www.research.yorku.ca

Memo

To: Professor Joel Katz, Psychology, Faculty of Health, [redacted]

From: Alison M. Collins-Mrakas, Sr. Manager and Policy Advisor, Research Ethics
(on behalf of Denise Henriques, Chair, Human Participants Review Committee)

Date: **Friday October 24th, 2014**

Re: Ethics Approval

Transforming the Lived Experiences of Individuals Receiving Medical Reconditioning through a Hatha Yoga Program in an In-Patient Setting: A Collaborative and Tailored Approach

---

I am writing to inform you that the Human Participants Review Sub-Committee has reviewed the amendments to the above project described in the "Request for Approval of an Amendment to an Approved Protocol" form (on file) and, as the amendments to the protocol do not represent a substantive change to the methodology or the risks to the participants or participant pool or any other aspect of the project, no further ethics review is required and renewed approval is granted.

Should you have any questions, please feel free to contact me at: [redacted] or via email at: [redacted].

Yours sincerely,

Alison M. Collins-Mrakas M.Sc., LLM
Sr. Manager and Policy Advisor,
Office of Research Ethics

RESEARCH ETHICS: PROCEDURES to ENSURE ONGOING COMPLIANCE

Upon receipt of an ethics approval certificate, researchers are reminded that they are required to ensure that the following measures are undertaken so as to ensure on-going compliance with Senate and TCPS ethics guidelines:

1. **RENEWALS:** Research Ethics Approval certificates are subject to annual renewal. **It is the responsibility of researchers to ensure the timely submission of renewals.**
    a. As a courtesy, researchers will be reminded by ORE, in advance of certificate expiry, that the certificate must be renewed. Please note, however, it is the expectation that researchers will submit a renewal application prior to the expiration of ethics certificate(s).
    b. **Failure to renew an ethics approval certificate** (or to notify ORE that no further research involving human participants will be undertaken) **may result in suspension of research cost fund and access to research funds may be suspended/ withheld**.

2. **AMENDMENTS:** Amendments must be reviewed and approved **PRIOR** to undertaking/making the proposed amendments to an approved ethics protocol;

3. **END OF PROJECT**: ORE must be notified when a project is complete;

4. **ADVERSE EVENTS**: Adverse events must be reported to ORE as soon as possible;

5. **POST APPROVAL MONITORING:**
    a. More than minimal risk research may be subject to post approval monitoring as per TCPS guidelines;
    b. A spot sample of minimal risk research may similarly be subject to Post Approval Monitoring as per TCPS guidelines.

FORMS: As per the above, the following forms relating to on-going research ethics compliance are available on the Research website:

a. Renewal
b. Amendment
c. End of Project
d. Adverse Event

Appendix B: Yoga for Spinal Cord Injury: Study Two Materials and Measures

Quantitative Questionnaires

Qualitative Questions

Consent Form

REB Approvals from the TRI and York University HPRC

Permission from TRJ to Reproduce the Published Manuscript

Appendix B: Quantitative Measures

Yoga Satisfaction Scale – YSS

Brief Pain Inventory- Short Form – BPI-SF (one item rephrased)

Pain Catastrophizing Scale – PCS

Toronto Mindfulness Scale – TMS

Cognitive Affective Mindfulness Scale Revised – CAMS-R

Positive and Negative Affect – PANAS

General Self-Efficacy Scale – GSES

Fatigue Severity Scale – FSS

Yoga Satisfaction Scale

ID: _____ Date_____

Please complete the following:

Gender: ☐ Male ☐ Female

Age: _____

Months post injury/ Date of Onset: _____

Level of Injury/Lesion: _____ ☐ Tetraplegia ☐ Paraplegia ☐ Unknown

Cause of SCI or spinal related condition: _____

Severity of SCI /lesion: ☐ Complete ☐ Incomplete ☐ Don't know/Not applicable.

I found the Yoga class enjoyable

1	2	3	4	5	6	7	8	9	10
Strongly Disagree									Strongly Agree

The Yoga class helped me feel relaxed

1	2	3	4	5	6	7	8	9	10
Strongly Disagree									Strongly Agree

I would come to more Yoga classes like this

1	2	3	4	5	6	7	8	9	10
Strongly Disagree									Strongly Agree

What was your favorite part of the class?

_____

_____

_____

_____

What would you like to see improved for the next class

_____

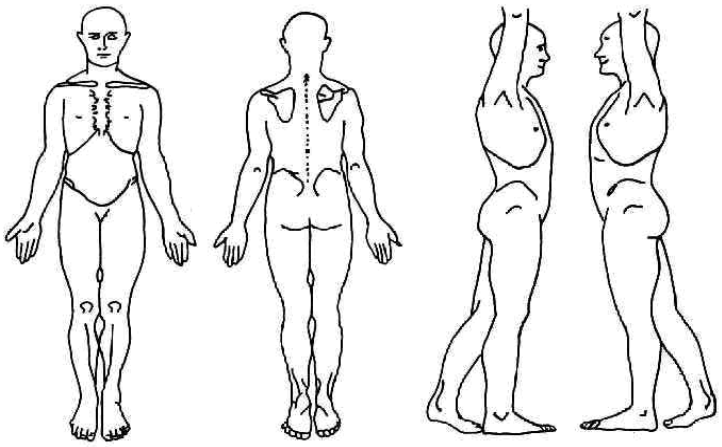
_____

_____

_____

BRIEF PAIN INVENTORY (BPI) – Short Form

1. Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, toothaches). Have you had pain other than these everyday kind of pains during the last week? **NO_____** **YES____**
2. Please describe on your body you feel pain. Please describe which area hurts the most (Place an X on these areas).



Pain Location/Site	Right	Midline	Left	Worst
Head	☐	☐	☐	☐
Neck/Shoulders				
Throat	☐	☐	☐	☐
Neck	☐	☐	☐	☐
Shoulder	☐	☐	☐	☐
Arms/Hands				
Upper arm	☐	☐	☐	☐
Elbow	☐	☐	☐	☐
Forearm	☐	☐	☐	☐
Wrist	☐	☐	☐	☐
Hand/Fingers	☐	☐	☐	☐
Front Torso/Genitals				
Chest	☐	☐	☐	☐
Abdomen	☐	☐	☐	☐
Pelvis/Genitalia	☐	☐	☐	☐

Yoga Draft 23

Pain Location/Site	Right	Midline	Left	Worst
Back				
Upper back	☐	☐	☐	☐
Lower back	☐	☐	☐	☐
Buttocks/Hips				
Buttocks	☐	☐	☐	☐
Hips	☐	☐	☐	☐
Anus	☐	☐	☐	☐
Upper Legs/Thighs	☐	☐	☐	☐
Lower Legs/Feet				
Knee	☐	☐	☐	☐
Shin	☐	☐	☐	☐
Calf	☐	☐	☐	☐
Ankle	☐	☐	☐	☐
Foot/Toes	☐	☐	☐	☐

3. Please rate your pain that best describes your pain at its **worst** in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10

No Pain — Pain as bad as you can imagine

4. Please rate your pain that best describes your pain at its **least** in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10

No Pain — Pain as bad as you can imagine

5. Please rate your pain that best describes your pain on the **average**.

0	1	2	3	4	5	6	7	8	9	10

No Pain — Pain as bad as you can imagine

6. Please rate your pain that tells how much pain you have **right now**.

0	1	2	3	4	5	6	7	8	9	10

No Pain — Pain as bad as you can imagine

7. In the last 24 hours, how much relief have pain treatments or medications provided?

0	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No Relief										Complete Relief

8. During the past 24 hours, pain has interfered with your:

General Activity

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Mood

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Mobility

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Normal Work

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Relations with Other People

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Sleep

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

Enjoyment of life

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

COMMENTS: _____
_____
_____

PCS

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0 – not at all

1 – to a slight degree

2 – to a moderate degree

3 – to a great degree

4 – all the time

When I'm in pain …

1. ____ I worry all the time about whether the pain will end.
2. ____ I feel I can't go on.
3. ____ It's terrible and I think it's never going to get any better.
4. ____ It's awful and I feel that it overwhelms me.
5. ____ I feel I can't stand it anymore.
6. ____ I become afraid that the pain will get worse.
7. ____ I keep thinking of other painful events.
8. ____ I anxiously want the pain to go away.
9. ____ I can't seem to keep it out of my mind.
10. ____ I keep thinking about how much it hurts.
11. ____ I keep thinking about how badly I want the pain to stop.
12. ____ There's nothing I can do to reduce the intensity of the pain.
13. ____ I wonder whether something serious may happen.

Toronto Mindfulness Scale

Instructions: We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement. Next to each statement are five choices: "not at all", "a little", "moderately", "quite a bit" and "very much". Please indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced, just now?	**Not at all**	**A little**	**Moderately**	**Quite a bit**	**Very much**
1. I experienced myself as separate from my changing thoughts and feelings.	0	1	2	3	4
2. I was more concerned with being open to my experiences than controlling or changing them.	0	1	2	3	4
3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations.	0	1	2	3	4
4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things 'really' are.	0	1	2	3	4
5. I was curious to see what my mind was up to from moment to moment.	0	1	2	3	4
6. I was curious about each of the thoughts and feelings that I was having.	0	1	2	3	4
7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.	0	1	2	3	4
8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.	0	1	2	3	4
9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.	0	1	2	3	4
10. I remained curious about the nature of each experience as it arose.	0	1	2	3	4
11. I was aware of my thoughts and feelings without over-identifying with them.	0	1	2	3	4
12. I was curious about my reactions to things.	0	1	2	3	4
13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.	0	1	2	3	4

Cognitive and Affective Mindfulness Scale-Revised (CAMS-R)

People have a variety of ways of relating to their thoughts and feelings. For each of the itmes below, rate how much each of these ways applies to you.

1. It is easy for me to concentrate on what I am doing

1	2	3	4
Rarely	Sometimes	Often	Almost Always

2. I am preoccupied by the future

1	2	3	4
Rarely	Sometimes	Often	Almost Always

3. I can tolerate emotional pain

1	2	3	4
Rarely	Sometimes	Often	Almost Always

4. I can accept things I cannot change

1	2	3	4
Rarely	Sometimes	Often	Almost Always

5. I can usually describe how I feel at the moment in considerable detail

1	2	3	4
Rarely	Sometimes	Often	Almost Always

6. I am easily distracted.

1	2	3	4
Rarely	Sometimes	Often	Almost Always

7. I am preoccupied by the past

1	2	3	4
Rarely	Sometimes	Often	Almost Always

8. It’s easy for me to keep track of my thoughts and feelings

1	2	3	4
Rarely	Sometimes	Often	Almost Always

9. I try to notice my thoughts without judging them

1	2	3	4
Rarely	Sometimes	Often	Almost Always

10.I am able to accept the thoughts and feelings I have.

1	2	3	4
Rarely	Sometimes	Often	Almost Always

11.I am able to focus on the present moment.

1	2	3	4
Rarely	Sometimes	Often	Almost Always

12.I am able to pay close attention to one thing for a longer period of time.

1	2	3	4
Rarely	Sometimes	Often	Almost Always

General Self-Efficacy Scale

Instructions: Read each statement carefully. Please circle the response that describes you best.

1 = Not at all true
2 = Hardly true
3 = Moderately true
4 = Exactly true

1.	I can always manage to solve difficult problems if I try hard enough.	1 2 3 4
2.	If someone opposes me, I can find the means and ways to get what I want	1 2 3 4
3.	It is easy for me to stick to my aims and accomplish my goals.	1 2 3 4
4.	I am confident that I could deal efficiently with unexpected events.	1 2 3 4
5.	Thanks to my resourcefulness, I know how to handle unforeseen situations.	1 2 3 4
6.	I can solve most problems if I invest the necessary effort.	1 2 3 4
7.	I can remain calm when facing difficulties because I can rely on my coping abilities.	1 2 3 4
8.	When I am confronted with a problem, I can usually find several solutions.	1 2 3 4
9.	If I am in trouble, I can usually think of a solution.	1 2 3 4
10.	I can usually handle whatever comes my way.	1 2 3 4

THE POSITIVE AFFECT AND NEGATIVE AFFECT SCHEDULE (PANAS)

This scale consists of a number of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt during the past few weeks.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

_____interested	_____irritable
_____distressed	_____alert
_____excited	_____ashamed
_____upset	_____inspired
_____strong	_____nervous
_____guilty	_____determined
_____scared	_____attentive
_____hostile	_____jittery
_____enthusiastic	_____active
_____proud	_____afraid

FATIGUE SEVERITY SCALE (FSS)

Date _____ Name _____

Please circle the number between 1 and 7 which you feel best fits the following statements. This refers to your usual way of life within the last week. 1 indicates "strongly disagree" and 7 indicates "strongly agree."

Read and circle a number.	Strongly Disagree → Strongly Agree						
1. My motivation is lower when I am fatigued.	1	2	3	4	5	6	7
2. Exercise brings on my fatigue.	1	2	3	4	5	6	7
3. I am easily fatigued.	1	2	3	4	5	6	7
4. Fatigue interferes with my physical functioning.	1	2	3	4	5	6	7
5. Fatigue causes frequent problems for me.	1	2	3	4	5	6	7
6. My fatigue prevents sustained physical functioning.	1	2	3	4	5	6	7
7. Fatigue interferes with carrying out certain duties and responsibilities.	1	2	3	4	5	6	7
8. Fatigue is among my most disabling symptoms.	1	2	3	4	5	6	7
9. Fatigue interferes with my work, family, or social life.	1	2	3	4	5	6	7

Appendix B: Qualitative Questions

INTRODUCTION

Thank you XXXX for agreeing to be interviewed for the evaluation of the yoga program. This to remind you that this interview will be tape-recorded and I may also be jotting down some notes. All of this information is confidential. Is that okay with you? This interview will take about 15 minutes, is that okay with you?

Begin recording

Date:
Subject
ID:
Study
Name:
Time:

___has just given consent to be interviewed for the program evaluation of the yoga program. Thank you! The purpose of this interview is to get an understanding of your experiences from participating in the yoga classes.

Question 1:
What were your expectations of the yoga program?

Question 2:
What aspects of the program did you find enjoyable?

Question 3:
What aspects of the program did you not like or thought could be improved?

Question 4:
What were some of the changes (emotional, physical, etc.), if any, you noticed about yourself during or after the yoga program?

Question 5:
Overall, how satisfied were you with the program?

Appendix B: Consent Form

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University Health Network

Version 2 – February 16, 2012

Evaluation of a Yoga Program for Persons with Spinal Cord Injury

Informed Consent – Yoga Participants

Program Evaluation and Research Team

Principal Investigator:
Sander L. Hitzig, PhD
Scientist
University Health Network, Toronto Rehab, Lyndhurst Centre
[redacted]

Co-Investigators:
Nicole Leong, B.A., TR
Therapeutic Recreationist
University Health Network
Toronto Rehab, Lyndhurst Centre
[redacted]

David S. Ditor, PhD
Associate Professor
Department of Kinesiology
Brock University
[redacted]

Introduction

The yoga program is provided by the University Health Network's Toronto Rehab Spinal Cord Rehabilitation Program (SCRP). The program is an adapted yoga program for people with spinal cord injury (SCI). To help us improve current practices, we are asking you to take part in a research project. We want to see if people with SCI who take part in an 8-week yoga program will improve their well-being. We want to see if people report feeling better and if they can concentrate better. The findings may help us to better understand the effects of yoga for people with SCI.

It is important that you read and understand the following explanation of what we are asking you to do. The following information describes the purpose, procedures, benefits, discomforts, risks and precautions associated with this research project. It also describes your right to refuse to take part or withdraw from the project at any time. To help you decide if you want to take part in the project, you should understand enough about its risks and benefits to be able to make an informed decision.

This is known as the informed consent process. You should be comfortable that all your questions have been answered to your satisfaction before signing this document.

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Purpose

There are many studies showing the benefits of yoga for people with different health problems. At this time, we know very little about the benefits of yoga for people with SCI. We are asking you to give us feedback on the program. This will help us learn more about the effects of yoga for people with SCI. Your answers will also help us to improve future yoga programs and to better understand how it may benefit you. We are asking your permission to let us publish the information we collect from you. We will only report on group findings. You will not be identified in any way.

Procedure

We are asking your permission to access some information that is normally collected when you take part in the yoga program. We are also asking you to complete some extra surveys. These surveys ask questions on your feelings, how you see your abilities to do different things, and your health.

The surveys that are normally collected by the clinicians running the program ask questions about your background. The survey asks questions about your age and gender, and your injury. The surveys also ask your opinion on the yoga class, and on your ability to concentrate after each yoga class. We are asking for your permission to use this information for research purposes. These questions are asked at the end of each yoga class. These questions should take about 5 minutes to complete. The surveys will be done by the staff members running the yoga program (N. Leong).

For the research part, you are being asked to complete some surveys before starting and after finishing the 8-week yoga session. These questions should take about 15 minutes to complete. The surveys ask questions about your health, mood, ability to concentrate, and energy levels. The surveys will be done by a member of the research team.

You are also being asked to take part in a brief 20 minute interview. The interview will be audio-taped. The interview is to get your feedback on the program. The interviews will be done by a member of research (Sander Hitzig, PhD).

Data Collection

The information collected will be stored electronically and password protected on the Toronto Rehab secure server. Hard copies will be kept locked in a locked location at Lyndhurst. We will keep this information on file for 7 years.

Completing the two surveys described above is part of standard care of taking part in the program but you have the right not to answer certain questions if you feel uncomfortable doing so. You also have the right not to complete part or all of the surveys or interviews.

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Risks and Discomforts

To the best of our knowledge, there are no risks or discomforts involved in taking part in this research project. You may feel uncomfortable answering some questions. If you do feel troubled at any time during the project, you can contact Dr. Sander Hitzig, the research member of the evaluation team to talk about your concerns at [redacted]

Expected Benefits

By taking part in this project, you may help to develop a better understanding of the benefits of programs for persons with SCI that are designed to help them live independently in their communities. This information may also help inform other rehabilitation hospitals of the benefits of these types of programs.

Participation

You may withdraw from parts of the program evaluation. This means you have the right not to answer specific questions on the surveys. This includes not answering questions that are collected normally for the program or the questions from the optional surveys and interview. You may choose not to answer a certain question or stop taking part in the project at any time without any impact on the services you are currently receiving or will receive in the future from Toronto Rehab – Lyndhurst Centre. If you decide to withdraw from the project after the report has been published, we will erase your interview data file in the database. Please note that you will not receive payment for taking part in this project.

Confidentiality

Your name will not appear anywhere in the final report. All results will be reported as group averages. Your data will be anonymized in a database. This means your name will not appear on any of the hard-copies of the surveys or in the database. All hard copies will be kept in a locked filing cabinet. Only authorized members of the research team will have access to the data.

Further Information

If you have questions about your rights as a research participant, or about any ethical issues relating to this study, you can contact someone who is independent of the project team. Please call the Research Ethics Board Office at [redacted].

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Consent

I understand that my taking part will mean giving the project team permission to gain access to information that is normally collected when taking part in the yoga program. I understand that I am being asked to complete some surveys and one 20-minute interview. I understand that I will not be receiving payment for taking part in this project. The research member of the project team whose name appears below has explained the study to me. I have had the chance to discuss this project and my questions have been answered to my satisfaction. I understand the possible risks and discomforts. I know I can stop being part of this service and the project at any time without penalty. I also understand that my taking part is confidential and that my identity will not be apparent in the final study results. I understand that a copy of this consent form will be sent to me either in person or by return mail.

I voluntarily consent to participate in this project. My consent to participate in this project is shown by my signature below.

Your name	Your signature
Witness	
Researcher's name	Researcher's signature
Date	

Appendix B: REB Approvals from TRI and York University HPRC

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www.torontorehab.com

February 23, 2012

Dr. Sander Hitzig
Toronto Rehabilitation Institute
Lyndhurst Centre
520 Sutherland Drive
Toronto, Ontario
M4G 3V9

Dear Dr. Hitzig:

RE: TRI REB #: 12-003
Evaluation of a Yoga Program for Persons with Spinal Cord Injury

The Toronto Rehabilitation Institute Research Ethics Board has reviewed the above-named submission. Any concerns and requested revisions have been addressed to the satisfaction of the REB. The protocol version 2, dated February 20, 2012 is approved for use for the next 12 months. If the study is expected to continue beyond the expiry date, you are responsible for ensuring the study receives re-approval. The REB must also be notified of the completion or termination of this study and a final report provided.

Also approved are the following documents:
- Appendix B: Outcome Measures version 2, dated February 20, 2012
    - Yoga Satisfaction Scale
    - Toronto Mindfulness Scale (TMS)
    - Positive Affect and Negative Affect Schedule (PANAS)
    - General Self-Efficacy Scale (GSES)
    - Fatigue Severity Scale
- Appendix C: Qualitative Interview Questions version 2, dated February 20, 2012
- Appendix D: Referral and Pre-Screening Questionnaire version 2, dated February 20, 2012
- Informed Consent Form – Yoga Participants version 2, dated February 16, 2012
- Recruitment Ad version 1, dated January 5, 2012

The following document has been acknowledged:
- Appendix A: Program Evaluation of SCI Yoga Program – Lyndhurst Yoga Program Description, version 2, dated February 20, 2012

.../2

If, during the course of the research, there are any serious adverse events, changes in the approved protocol or consent form or any new information that must be considered with respect to the study, these should be brought to the immediate attention of the Board.

Best wishes for the successful completion of your project.

Yours sincerely,

[redacted]

[ ] Paul Oh MD, MSc, FRCPC, FACP
Chair, Research Ethics Board
Toronto Rehabilitation Institute

[√] Ann Heesters BEd, BA, MA, PhD (ABD)
Vice Chair, Research Ethics Board
Toronto Rehabilitation Institute

February 23, 2012
Date of Initial REB Approval

February 23, 2013
Expiry Date of REB Approval

YORK
UNIVERSITÉ
UNIVERSITY

OFFICE OF RESEARCH ETHICS (ORE)
5th Floor, Kaneff Tower

4700 Keele St.
Toronto ON
Canada M3J 1P3
Tel 416 736 5914
Fax 416 736-5512
www.research.yorku.ca

Certificate #:	**STU 2017 - 045**
Approval Period:	**04/24/17-04/24/18**

ETHICS APPROVAL

To: **Kathryn Curtis**
Graduate Student of Clinical Psychology, Faculty of Health
[redacted]

From: Alison M. Collins-Mrakas, Sr. Manager and Policy Advisor, Research Ethics
(on behalf of Denise Henriques, Chair, Human Participants Review Committee)

Date: Monday, April 24, 2017

Title: **Evaluation of a Yoga Program for Persons with Spinal Cord Injury**

Risk Level: ☒ Minimal Risk ☐ More than Minimal Risk

Level of Review: ☒ Delegated Review ☐ Full Committee Review

I am writing to inform you that this research project, **"Evaluation of a Yoga Program for Persons with Spinal Cord Injury"** has received ethics review and approval by the Human Participants Review Sub-Committee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics guidelines.

Note that approval is granted for one year. Ongoing research – research that extends beyond one year – must be renewed prior to the expiry date.

Any changes to the approved protocol must be reviewed and approved through the amendment process by submission of an amendment application to the HPRC prior to its implementation.

Any adverse or unanticipated events in the research should be reported to the Office of Research ethics [redacted] as soon as possible.

For further information on researcher responsibilities as it pertains to this approved research ethics protocol, please refer to the attached document, **"RESEARCH ETHICS: PROCEDURES to ENSURE ONGOING COMPLIANCE".**

Should you have any questions, please feel free to contact me at: [redacted] or via email at: [redacted]

Yours sincerely,

Alison M. Collins-Mrakas M.Sc., LLM
Sr. Manager and Policy Advisor,
Office of Research Ethics

RESEARCH ETHICS: PROCEDURES to ENSURE ONGOING COMPLIANCE

Upon receipt of an ethics approval certificate, researchers are reminded that they are required to ensure that the following measures are undertaken so as to ensure on-going compliance with Senate and TCPS ethics guidelines:

1. **RENEWALS:** Research Ethics Approval certificates are subject to annual renewal. **It is the responsibility of researchers to ensure the timely submission of renewals.**
    a. As a courtesy, researchers will be reminded by ORE, in advance of certificate expiry, that the certificate must be renewed. Please note, however, it is the expectation that researchers will submit a renewal application prior to the expiration of ethics certificate(s).
    b. **Failure to renew an ethics approval certificate** (or to notify ORE that no further research involving human participants will be undertaken) **may result in suspension of research cost fund and access to research funds may be suspended/ withheld**.

2. **AMENDMENTS:** Amendments must be reviewed and approved **PRIOR** to undertaking/making the proposed amendments to an approved ethics protocol;

3. **END OF PROJECT**: ORE must be notified when a project is complete;

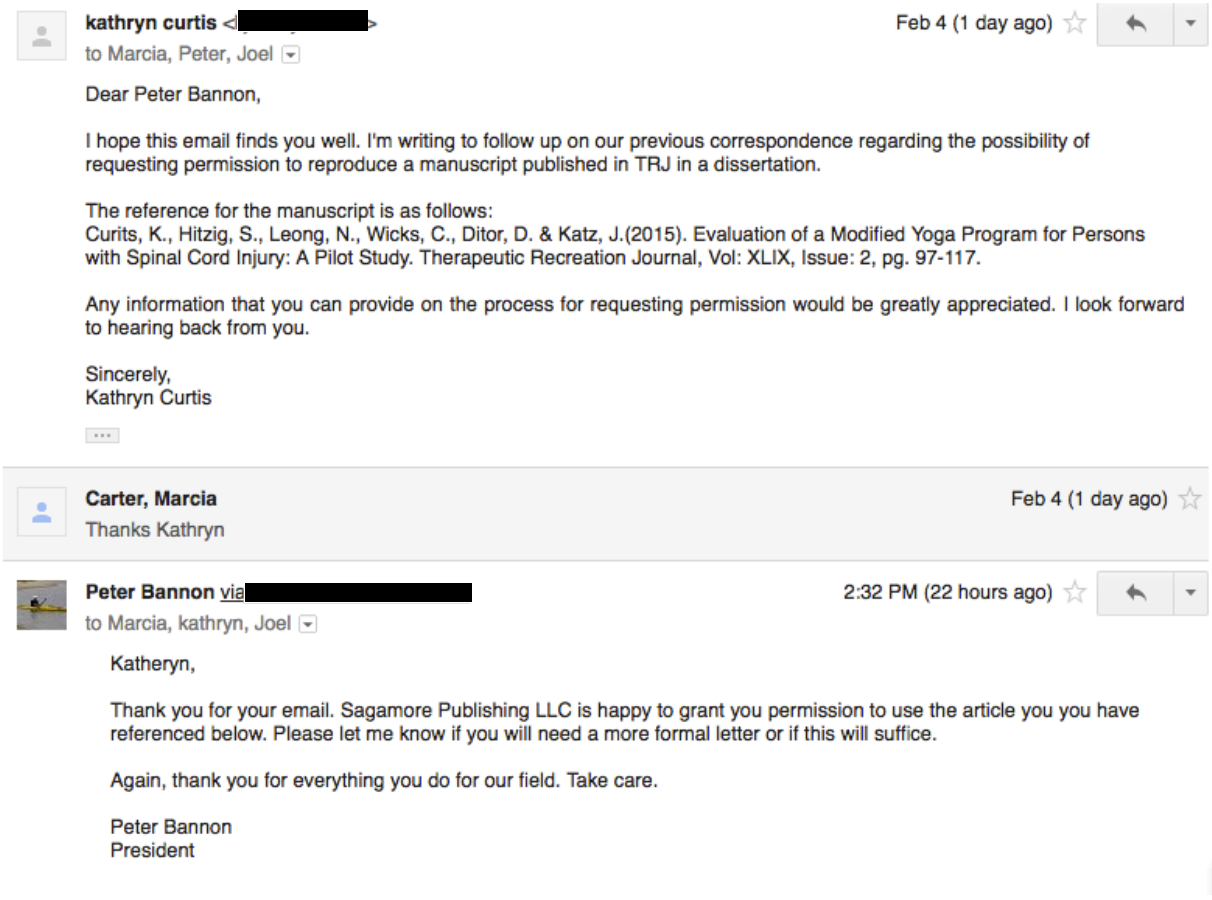
4. **ADVERSE EVENTS**: Adverse events must be reported to ORE as soon as possible;

5. **POST APPROVAL MONITORING:**
    a. More than minimal risk research may be subject to post approval monitoring as per TCPS guidelines;
    b. A spot sample of minimal risk research may similarly be subject to Post Approval Monitoring as per TCPS guidelines.

FORMS: As per the above, the following forms relating to on-going research ethics compliance are available on the Research website:

a. Renewal
b. Amendment
c. End of Project
d. Adverse Event

Appendix B: Permission from TRJ to Reproduce the Published Manuscript



kathryn curtis <[redacted]>
Feb 4 (1 day ago)
to Marcia, Peter, Joel

Dear Peter Bannon,

I hope this email finds you well. I'm writing to follow up on our previous correspondence regarding the possibility of requesting permission to reproduce a manuscript published in TRJ in a dissertation.

The reference for the manuscript is as follows:
Curits, K., Hitzig, S., Leong, N., Wicks, C., Ditor, D. & Katz, J.(2015). Evaluation of a Modified Yoga Program for Persons with Spinal Cord Injury: A Pilot Study. Therapeutic Recreation Journal, Vol: XLIX, Issue: 2, pg. 97-117.

Any information that you can provide on the process for requesting permission would be greatly appreciated. I look forward to hearing back from you.

Sincerely,
Kathryn Curtis

Carter, Marcia
Feb 4 (1 day ago)
Thanks Kathryn

Peter Bannon via [redacted]
2:32 PM (22 hours ago)
to Marcia, kathryn, Joel

Katheryn,

Thank you for your email. Sagamore Publishing LLC is happy to grant you permission to use the article you you have referenced below. Please let me know if you will need a more formal letter or if this will suffice.

Again, thank you for everything you do for our field. Take care.

Peter Bannon
President

Appendix C: Yoga for Spinal Cord Injury: Study Three Materials and Measures

Quantitative Questionnaires

Demographic Information, Health History and Current Health Status

Qualitative Questions

Recruitment Poster/Information Sheet

Consent Form

REB Approvals from UHN and York University HPRC

Appendix C: Quantitative Measures

Acceptance and Action Questionnaire-II – AAQ-II

Hospital Anxiety and Depression Scale-Anxiety/Depression – HADS-A/D

General Self-Efficacy Scale – GSES

Posttraumatic Growth Inventory – PTGI-SF

Connor-Davidson Resilience Scale-10 Item – CS-RISC-10

Five Facet Mindfulness Questionnaire-SF – FFMQ-SF

Self-Compassion Scale-SF – SCS-SF

Brief Pain Inventory-SF – BPI-SF

Pain Catastrophizing Scale – PCS

AAQ-II

Below you will find a list of statements. Please rate how true each statement is for you by circling a number next to it. Use the scale below to make your choice.

1	2	3	4	5	6	7
never true	very seldom true	seldom true	sometimes true	frequently true	almost always true	always true

1. My painful experiences and memories make it difficult for me to live a life that I would value.	1	2	3	4	5	6	7
2. I'm afraid of my feelings.	1	2	3	4	5	6	7
3. I worry about not being able to control my worries and feelings.	1	2	3	4	5	6	7
4. My painful memories prevent me from having a fulfilling life.	1	2	3	4	5	6	7
5. Emotions cause problems in my life.	1	2	3	4	5	6	7
6. It seems like most people are handling their lives better than I am.	1	2	3	4	5	6	7
7. Worries get in the way of my success.	1	2	3	4	5	6	7

Hospital Anxiety and Depression Scale (HADS)

Health care professionals are aware that emotions play an important part in most illnesses. If your health care professional knows about these feelings he or she will be able to help you more.Read each item below and place a check (✓) in the box beside the reply which comes closest to how you have been feeling in the past week.

1. I feel tense or "wound up"

☐ Most of the time
☐ A lot of time
☐ From time to time
☐ Not at all

2. I still enjoy the things I used to enjoy

☐ Definitely as much
☐ Not quite so much
☐ Only a little
☐ Hardly at all

3. I get sort of frightened feeling as if something awful is about to happen

☐ Very definitely and quite badly
☐ Yes, but not to badly
☐ A little, but it doesn't worry me
☐ Not at all

4. I can laugh and see the funny side of things

☐ As much as I always could
☐ Not quite so much now
☐ Definitely not so much now
☐ Not at all

5. Worrying thoughts go through my mind

☐ A great deal of the time
☐ A lot of the time
☐ Not too often
☐ Very little

6. I feel cheerful

☐ Never
☐ Not often
☐ Sometimes
☐ Most of the time

7. I can sit at ease and feel relaxed

☐ Definitely
☐ Usually
☐ Not often
☐ Not at all

8. I feel as if I am slowed down

☐ Nearly all the time
☐ Very often
☐ Sometimes
☐ Not at all

9. I get a sort of frightened feeling like "butterflies" in the stomach

☐ Not at all
☐ Occasionally
☐ Quite often
☐ Very often

10. I have lost interest in my appearance

☐ Definitely
☐ I don't take as much care as I should
☐ I may not take quite much care
☐ I take just as much care as ever

11. I feel restless as if I have to be on the move

☐ Very much indeed
☐ Quite a lot
☐ Not very much
☐ Not at all

12. I look forward with enjoyment to things

☐ As much as I ever did
☐ Rather less than I used to
☐ Definitely less than I used to
☐ Hardly at all

13. I get sudden feeling of panic

☐ Very often indeed
☐ Quite often
☐ Not very often
☐ Not at all

14. I can enjoy a good book or radio or television program

☐ Often
☐ Sometimes
☐ Not often
☐ Very seldom

General Self-Efficacy Scale

Instructions: Read each statement carefully. Please circle the response that describes you best.

1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Exactly true

1. I can always manage to solve difficult problems if I try hard enough.	1 2 3 4
2. If someone opposes me, I can find the means and ways to get what I want	1 2 3 4
3. It is easy for me to stick to my aims and accomplish my goals.	1 2 3 4
4. I am confident that I could deal efficiently with unexpected events.	1 2 3 4
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.	1 2 3 4
6. I can solve most problems if I invest the necessary effort.	1 2 3 4
7. I can remain calm when facing difficulties because I can rely on my coping abilities.	1 2 3 4
8. When I am confronted with a problem, I can usually find several solutions.	1 2 3 4
9. If I am in trouble, I can usually think of a solution.	1 2 3 4
10. I can usually handle whatever comes my way.	1 2 3 4

The Posttraumatic Growth Inventory-SF

Instructions: Indicate for each of the statements below the degree to which this change occurred in your life as a result of your crisis, using the following scale:

0 = I did not experience this change as a result of my crisis
1 = I experienced this change to a very small degree as a result of my crisis
2 = I experienced this change to a small degree as a result of my crisis
3 = I experienced this change to a moderate degree as a result of my crisis
4 = I experienced this change to a great degree as a result of my crisis
5 = I experienced this change to a very great degree as a result of my crisis

1. I changed my priorities about what is important in life.	0	1	2	3	4	5
2. I have a greater appreciation for the value of my own life.	0	1	2	3	4	5
3. I am able to do better things with my life.	0	1	2	3	4	5
4. I have a better understanding of spiritual matters.	0	1	2	3	4	5
5. I have a greater sense of closeness with others.	0	1	2	3	4	5
6. I established a new path for my life.	0	1	2	3	4	5
7. I know better that I can handle difficulties.	0	1	2	3	4	5
8. I have a stronger religious faith.	0	1	2	3	4	5
9. I discovered that I'm stronger than I thought I was.	0	1	2	3	4	5
10. I learned a great deal about how wonderful people are.	0	1	2	3	4	5

CD-RISC-10

*Please indicate how much you agree with the following statements as they apply to you over the last **month**. If a particular situation has not occurred recently, answer according to how you think you would have felt.*

		not true at all (0)	rarely true (1)	sometimes true (2)	often true (3)	true nearly all the time (4)
1.	I am able to adapt when changes occur.	☐	☐	☐	☐	☐
2.	I can deal with whatever comes my way.	☐	☐	☐	☐	☐
3.	I try to see the humorous side of things when I am faced with problems.	☐	☐	☐	☐	☐
4.	Having to cope with stress can make me stronger.	☐	☐	☐	☐	☐
5.	I tend to bounce back after illness, injury, or other hardships.	☐	☐	☐	☐	☐
6.	I believe I can achieve my goals, even if there are obstacles.	☐	☐	☐	☐	☐
7.	Under pressure, I stay focused and think clearly.	☐	☐	☐	☐	☐
8.	I am not easily discouraged by failure.	☐	☐	☐	☐	☐
9.	I think of myself as a strong person when dealing with life's challenges and difficulties.	☐	☐	☐	☐	☐
10.	I am able to handle unpleasant or painful feelings like sadness, fear, and anger.	☐	☐	☐	☐	☐

ffmq-sf

Below is a collection of statements about your everyday experience. Using the 1–5 scale below, please indicate, in the box to the right of each statement, how frequently or infrequently you have had each experience in the last month (or other agreed time period). Please answer according to what really reflects your experience rather than what you think your experience should be.

never or very rarely true 1	***not often true 2***	***sometimes true sometimes not true 3***	***often true 4***	***very often or always true 5***

1	I'm good at finding the words to describe my feelings	
2	I can easily put my beliefs, opinions, and expectations into words	
3	I watch my feelings without getting carried away by them	
4	I tell myself that I shouldn't be feeling the way I'm feeling	
5	it's hard for me to find the words to describe what I'm thinking	
6	I pay attention to physical experiences, such as the wind in my hair or sun on my face	
7	I make judgments about whether my thoughts are good or bad.	
8	I find it difficult to stay focused on what's happening in the present moment	
9	when I have distressing thoughts or images, I don't let myself be carried away by them	
10	generally, I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing	
11	when I feel something in my body, it's hard for me to find the right words to describe it	
12	it seems I am "running on automatic" without much awareness of what I'm doing	
13	when I have distressing thoughts or images, I feel calm soon after	
14	I tell myself I shouldn't be thinking the way I'm thinking	

15	I notice the smells and aromas of things	
16	even when I'm feeling terribly upset, I can find a way to put it into words	
17	I rush through activities without being really attentive to them	
18	usually when I have distressing thoughts or images I can just notice them without reacting	
19	I think some of my emotions are bad or inappropriate and I shouldn't feel them	
20	I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow	
21	when I have distressing thoughts or images, I just notice them and let them go	
22	I do jobs or tasks automatically without being aware of what I'm doing	
23	I find myself doing things without paying attention	
24	I disapprove of myself when I have illogical ideas	

HOW I TYPICALLY ACT TOWARDS MYSELF IN DIFFICULT TIMES

Please read each statement carefully before answering. To the left of each item, indicate how often you behave in the stated manner, using the following scale:

Almost never				**Almost always**
1	**2**	**3**	**4**	**5**

_____1. When I fail at something important to me I become consumed by feelings of inadequacy.

_____2. I try to be understanding and patient towards those aspects of my personality I don't like.

_____3. When something painful happens I try to take a balanced view of the situation.

_____4. When I'm feeling down, I tend to feel like most other people are probably happier than I am.

_____5. I try to see my failings as part of the human condition.

_____6. When I'm going through a very hard time, I give myself the caring and tenderness I need.

_____7. When something upsets me I try to keep my emotions in balance.

_____8. When I fail at something that's important to me, I tend to feel alone in my failure

_____9. When I'm feeling down I tend to obsess and fixate on everything that's wrong.

_____10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.

_____11. I'm disapproving and judgmental about my own flaws and inadequacies.

_____12. I'm intolerant and impatient towards those aspects of my personality I don't like.

STUDY ID# _____ HOSPITAL # _____

DO NOT WRITE ABOVE THIS LINE

Brief Pain Inventory (Short Form)

Date: _____/_____/_____ Time: _____

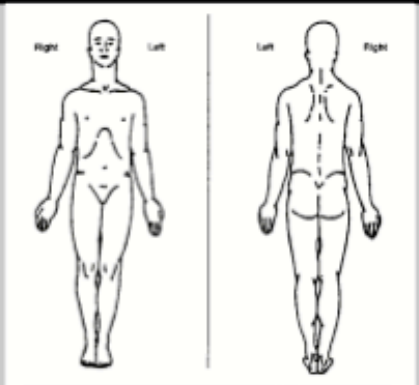
Name: _____ _____ _____

Last First Middle Initial

1. Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these every-day kinds of pain today?

1. Yes 2. No

2. On the diagram, shade in the areas where you feel pain. Put an X on the area that hurts the most.



3. Please rate your pain by circling the one number that best describes your pain at its worst in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10
No Pain										Pain as bad as you can imagine

4. Please rate your pain by circling the one nuimber that best describes your pain at its least in the last 24 hours.

0	1	2	3	4	5	6	7	8	9	10
No Pain										Pain as bad as you can imagine

5. Please rate your pain by circling the one number that best describes your pain on the average.

0	1	2	3	4	5	6	7	8	9	10
No Pain										Pain as bad as you can imagine

6. Please rate your pain by circling the one number that tells how much pain you have right now.

0	1	2	3	4	5	6	7	8	9	10
No Pain										Pain as bad as you can imagine

7. What treatments or medications are you receiving for your pain?

8. In the last 24 hours, how much relief have pain treatments or medications provided? Please circle the one percentage that most shows how much relief you have received.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No Relief										Complete Relief

9. Circle the one number that describes how, during the past 24 hours, pain has interfered with your:

A. General Activity

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

B. Mood

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

C. Walking Ability

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

D. Normal Work (includes both work outside the home and housework)

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

E. Relations with other people

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

F. Sleep

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

G. Enjoyment of life

0	1	2	3	4	5	6	7	8	9	10
Does not Interfere										Completely Interferes

PCS

Everyone experiences painful situations at some point in their lives. Such experiences may include headaches, tooth pain, joint or muscle pain. People are often exposed to situations that may cause pain such as illness, injury, dental procedures or surgery.

We are interested in the types of thoughts and feelings that you have when you are in pain. Listed below are thirteen statements describing different thoughts and feelings that may be associated with pain. Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

0 – not at all

1 – to a slight degree

2 – to a moderate degree

3 – to a great degree

4 – all the time

When I'm in pain …

14. ____ I worry all the time about whether the pain will end.
15. ____ I feel I can't go on.
16. ____ It's terrible and I think it's never going to get any better.
17. ____ It's awful and I feel that it overwhelms me.
18. ____ I feel I can't stand it anymore.
19. ____ I become afraid that the pain will get worse.
20. ____ I keep thinking of other painful events.
21. ____ I anxiously want the pain to go away.
22. ____ I can't seem to keep it out of my mind.
23. ____ I keep thinking about how much it hurts.
24. ____ I keep thinking about how badly I want the pain to stop.
25. ____ There's nothing I can do to reduce the intensity of the pain.
26. ____ I wonder whether something serious may happen.

Appendix C: Demographic Information, Health History and Current Health Status

Part I. Demographic Information

1. Participant ID#: _____

2. Date of Birth: _____
   mm/yyyy

3. Current age: _____

4. Height: _____

5. Weight: _____

6. What is your first language? _____

7. What socioeconomic class range do you identify with?
   7. ☐ $<25 000.00
   8. ☐ $20 000.00 - $39 000.00
   9. ☐ $40 000.00 - $59 000.00
   10. ☐ $60 000.00 - $79 000.00
   11. ☐ $80 000.00 - $100 000.00
   12. ☐ >$100 000.00
   13. ☐ Refused

8. What is your employment status?

☐ Employed ⟶ ☐ Full-time ☐ Part-time ☐ Modified

☐ Student ⟶ ☐ Full-time ☐ Part-time ☐ Modified

☐ Retired (because of age)
☐ Retired (because of disability)
☐ Unemployed
☐ Other: _____
If you're working, what is your occupation? _____

9. Highest level of school completed:

☐ Grade school ☐ High School ☐ College/University ☐ Postgraduate

Part II. Health History and Current Health Status

3. Date of injury/onset (DD/MM/YY): _____

4. Is your spinal cord injury (SCI) complete or incomplete? *Please check off the appropriate box*

☐ Complete ☐ Incomplete ☐ not applicable

2a. Which of the following best describes you?

☐ (A) No feeling or movement below the level of injury?
☐ (B) Feeling all the way down to your rectum/bum but no use of muscles.
☐ (C) Limited movement or muscle contractions below the level of injury but these serve no useful function
☐ (D) Functional, but not necessarily full use of at least half of the muscle groups below the level of injury
☐ (E) Feeling and movement is normal below level of injury

Other comments:

_____
_____
_____

5. Do you have paraplegia or tetraplegia? - *please check off the appropriate box*

☐ Paraplegia ☐ Tetraplegia ☐ not applicable

6. What is the level of your injury (e.g. T12, C1-2)? *Please describe:*

_____

7. Is the cause of your SCI traumatic (e.g., fall, car accident) or non-traumatic (e.g., tumor)? - *please check off the appropriate box*

☐ Traumatic ☐ Non-traumatic

8. If traumatic, what was the nature of the accident/trauma/injury?

_____

9. If non-traumatic, what is the cause of your SCI (e.g. *infection, degenerative condition, transverse myelitis, multiple sclerosis, spina bifida, tumour, vascular, syringomeylia, anterior horn disease, etc.*)? _____

10. Do you use any mobility aids?

11. ☐ No ☐ Yes; If yes, please check off all that apply:
☐ cane ☐ walker ☐ crutches ☐ leg braces ☐ scooter

☐ manual wheelchair ☐ power wheelchair ☐ other (please describe):_____

The Spinal Cord Injury Secondary Conditions Scale - Modified

For the following 16 health problems, please rate how much each one affected your activities and independence in the last 3 months. If you have not experienced a secondary condition in the last 3 months or if it is an insignificant problem for you, please circle ‘‘0.’’ Use the following scale to rate each of the secondary conditions.
0: NOT experienced in the last 3 months or is an insignificant problem.
1: MILD or INFREQUENT problem.
2: MODERATE or OCCASIONAL problem.
3: SIGNIFICANT or CHRONIC problem.

Health Problem	Description	Rating
Pressure sore(s)	These develop as a skin rash or redness and progress to an infected sore. Also called skin ulcers, bedsores, and decubitus ulcers.	0 1 2 3
Injury caused by loss of sensation	Injury may occur because of a lack of sensation, such as burns from carrying hot liquids in the lap or sitting too close to a heater or fire.	0 1 2 3
Muscle spasms (spasticity)	Spasticity refers to uncontrolled, jerky muscle movements, such as uncontrolled muscle twitch or spasm. Often spasticity increases with infection or some kind of restriction, like a tight shoe or belt.	0 1 2 3
Contractures	A contracture is a limitation in range of motion caused by a shortening of the soft tissue around a joint, such as an elbow or hip. This occurs when a joint cannot move frequently enough through its range of motion. Pain often accompanies this problem.	0 1 2 3
Heterotopic bone ossification	This is an overgrowth of bone, often occurring after a fracture. Early signs include a loss of range of motion, local swelling and warmth at the area to the touch. This condition must be diagnosed by a physician.	0 1 2 3
Diabetes mellitus	Diabetes is a problem resulting from irregularities in blood sugar levels. Symptoms include frequent urination and excessive thirst. This condition is diagnosed by a physician.	0 1 2 3
Bladder dysfunction	Incontinence, bladder or kidney stones, kidney problems, urine leakage and urine back up are all symptoms of bladder dysfunction. NOTE: There is a separate item for urinary tract infections.	0 1 2 3
Bowel dysfunction	Diarrhea, constipation, ‘‘accidents,’’ and associated problems are signs of bowel dysfunction.	0 1 2 3
Urinary tract infections	This includes infections such as cystitis and pseudomonas. Symptoms include pain when urinating, a burning sensation throughout the body, blood in the urine and cloudy urine.	0 1 2 3
Sexual dysfunction	This includes dissatisfaction with sexual functioning. Causes for dissatisfaction can be decreased sensation, changes in body image, difficulty in movement, and problems with bowel or bladder, like infections.	0 1 2 3
Autonomic dysreflexia	Autonomic dysreflexia, sometimes called hyperreflexia, results	0 1 2 3

	from interference in the body's temperature regulating systems. Symptoms of dysreflexia include sudden rises in blood pressure and sweating, skin blotches, goose bumps, pupil dilation and headache. It can also occur as the body's response to pain where an individual doesn't experience sensation.	
Postural hypotension	This involves a strong sensation of lightheadedness following a change in position. It is caused by a sudden drop in blood pressure.	0 1 2 3
Circulatory problems	Circulatory problems involve the swelling of veins, feet or the occurrence of blood clots.	0 1 2 3
Respiratory problems	Symptoms of respiratory infections or problems include difficulty in breathing and increased secretions.	0 1 2 3
Chronic pain	This is usually experienced as chronic tingling, burning or dull aches. It may occur in an area that has little to no feeling.	0 1 2 3
Joint and muscle pain	This includes pain in specific muscle groups or joints. People who must overuse a particular muscle group, such as shoulder muscles, or who put too much strain on their joints are at risk of developing pain.	0 1 2 3
Cardiac problems	An irregular heart rate often called atrial fibrillation or ventricular fibrillation. A heart attack occurs when blood supply to the heart muscle is blocked, and the muscle, or a part of it, dies. Heart failure occurs when the heart is not pumping effectively and fluid accumulates in the lungs.	0 1 2 3
High blood pressure	High blood pressure is diagnosed by a doctor, and occurs when your systolic blood pressure is over 140 mmHg (top number) or your diastolic is over 90 mmHg (bottom number).	0 1 2 3
Fracture	A crack or break in a bone.	0 1 2 3
Neurological deterioration	A reduction in your motor function and/or a negative change in your sensory function after discharge from rehabilitation.	0 1 2 3
Psychological distress	This may be feelings of unable to cope effectively, a change in emotional status (e.g., anxious, depressed mood), mental discomfort, decreased self-esteem, Note: There is a separate item for depression.	0 1 2 3
Depression	Symptoms include depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth. Depression is diagnosed and being treated by a physician or by a psychologist.	0 1 2 3
Other:	Additional information: _____ _____	0 1 2 3

12. Do you have any diagnoses for other physical or psychological health conditions health conditions than listed above? ☐ Yes ☐ N
    e. If yes, list the condition(s):
    _____
    _____

11. Are you taking medication for any of the above conditions?

☐ Yes ☐ No

a. If yes, list the medications:

_____

_____

Appendix C: Qualitative Questionnaires

Expectations for the Yoga Program

Thank you for taking the time to participate. We would like to know what you expect to gain from taking part in the Yoga study. Please describe any personal changes that you anticipate occurring over the following 6 weeks, as a result of taking part in this program.

If you don't expect any changes, please write "no expected changes". If you have difficulties holding a pen or writing, please find a staff member to help you fill this out.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Experiences of the Yoga Program

Thank you for taking the time to participate. We are interested in learning about your experiences as a participant in the Yoga Study. The interview today will be tape-recorded and I may also be writing down some notes (in case something happens with the tape recorder and/or to help me better understand something down the road). Is that okay with you? All of the information will be kept confidential. The interview will take approximately 30 minutes, is that ok with you?

I am going to start recording now.

Today is:

I am here with subject ID#

1) What were your experiences of the yoga program?
    a. Prompts:
        i. What were your reasons for participating?
        ii. What did you hope to achieve?
        iii. What did you like?
        iv. What didn't you like?

_____
_____
_____
_____

2) What benefits, if any, did you gain by participating in the yoga program?

a. Prompts:
   v. Physical benefits?
   vi. Mental benefits?
   vii. Emotional benefits?
   viii. Social benefits?

_____
_____
_____
_____
_____

2) Did you notice any negative effects of the yoga program and if so, what were they?

b. Prompts:
   i. Physical effects?
   ii. Mental effects?
   iii. Emotional effects?
   iv. Social effects?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

4) Did you notice any changes about how you handle challenges over the course of the yoga program, and if so, how?

_____
_____

5) Since you participated in the yoga program, how did your perceptions of your body change??

c. Prompts:
   v. How you feel about your body image?
   vi. How you feel about your physical capabilities?

_____
_____
_____
_____

6) What kind of shifts, if any, occurred in how you think about, understand or experience your sense of self throughout the yoga program?

_____
_____
_____
_____

7) Since you participated in the yoga program, have there been any changes in your perspective about your future?

_____
_____
_____
_____

8) Since you participated in the yoga program, how has your daily life changed?

_____
_____
_____
_____

9) Have there been any shifts in how you understand or think about your purpose in life?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Appendix C: Recruitment Materials

YORK UNIVERSITÉ UNIVERSITY

UHN Toronto Rehabilitation Institute

YOGA STUDY

We are looking for volunteers to participate in a specialized 6-week yoga program at the Lyndhurst Centre. We are looking for individuals who have sustained spinal cord injury (SCI) and who have had little or no experience doing yoga. Participation involves attending two yoga classes per week for 6 weeks and filling out some questionnaires before and after the yoga program.

The yoga classes will be specialized for individuals who are using wheelchairs and so all poses will be done in a seated position. However, it is not necessary to be in a wheelchair to participate. Each Hatha yoga class will be 50-60 minutes long, and will consist of upper body yoga postures, breathing techniques and relaxation practices. Hatha yoga is based on the development of mind-body unity and balance, and has been selected as an appropriate form of yoga for individuals with SCI since it is gentle and can be easily modified to accommodate for mobility difficulties. It focuses on breathing techniques and awareness building practices rather than strength building, though there is also an emphasis on movement.

If you are interested, you will be invited to an information session where you will have a chance to ask any questions. Should you decide to participate, you will fill out an informed consent form and then will be asked to obtain a physicians note indicating it is safe for you to participate. You will be asked to fill out some questionnaires and hand in the physicians note prior to the first yoga class. If you're interested in participating, please contact Kathryn Curtis, one of the study researchers, if you're interested in participating: [redacted] or [redacted]

Please note that the security of e-mail messages is not guaranteed. Messages may be forged, forwarded, kept indefinitely, or seen by others using the internet. Do not use e-mail to discuss information you think is sensitive. Do not use e-mail in an emergency since e-mail may be delayed.

Email Script:

To Whom it May Concern,

We are looking for volunteers to participate in a specialized 6-week yoga program at the Lyndhurst Centre. We are looking for individuals who have sustained spinal cord injury (SCI) and who have had little or no experience doing yoga. Participation involves attending two yoga classes per week for 6 weeks and filling out some questionnaires before and after the yoga program.

The yoga classes will be specialized for individuals who are using wheelchairs and so all poses will be done in a seated position. However, it is not necessary to be in a wheelchair to participate. Each Hatha yoga class will be 50-60 minutes long, and will consist of upper body yoga postures, breathing techniques and relaxation practices. Hatha yoga is based on the development of mind-body unity and balance, and has been selected as an appropriate form of yoga for individuals with SCI since it is gentle and can be easily modified to accommodate for mobility difficulties. It focuses on breathing techniques and awareness building practices rather than strength building, though there is also an emphasis on movement.

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Kind regards,

Kathryn Curtis
PhD Candidate – York University
Department of Psychology

Appendix C: Consent Form

CONSENT FORM TO PARTICIPATE IN A RESEARCH STUDY
Version Date: 17/11/2015

Study Title: Evaluation of a Specialized Yoga Program for Persons with Spinal Cord Injury (SCI): A Randomized Controlled Trial

Study Investigator - Contact Information:

Principal Investigator:
Dr. Sander Hitzig
Affiliate Scientist – Toronto Rehabilitation Institute, University Health Network
Adjunct Faculty Member – School of Kinesiology and Health Science, York University

Tel: [redacted]
Email: [redacted]

Co-Investigators:
Dr. Joel Katz
Professor
Canada Research Chair in Health Psychology
York University

Tel: [redacted]
Email: [redacted]

Kathryn Curtis
PhD Candidate
York University

Tel: [redacted]
Email: [redacted]

Dr. Colleen McGillivray
Staff Physiatrist
Lyndhurst Centre, Toronto Rehabilitation Institute, University Health Network

Tel: [redacted]
Email: [redacted]

Please note that the security of e-mail messages is not guaranteed. Messages may be forged, forwarded, kept indefinitely, or seen by others using the internet. Do not use e-mail to discuss information you think is sensitive. Do not use e-mail in an emergency since e-mail may be delayed.

Introduction:
You are being asked to take part in a research study. Please read the information about the study presented in this form. The form includes details on study's risks and benefits that you should

know before you decide if you would like to take part. You should take as much time as you need to make your decision. You should ask the study investigator or study staff to explain anything that you do not understand and make sure that all of your questions have been answered before signing this consent form. Before you make your decision, feel free to talk about this study with anyone you wish including your friends, family, and family doctor. Participation in this study is voluntary.

Background/Purpose:
Individuals who live with SCI may experience challenges in a variety of physical and psychological areas, including difficulties with pain, energy levels, and mood, and may also experience changes in social relationships, jobs, moving around, or everyday tasks. Yoga has been shown to help with many of these areas in people with chronic health conditions or who have limited movement.

The purpose of this study is to evaluate pain, mood, anxiety, and other psychological experiences in individuals, like yourself, who live with SCI. We are asking you to give us feedback about your experiences with the yoga program to help us learn more about how it might be helpful. We are asking your permission to let us publish the information we collect from you, but you will not be identified in any way.

This research is being conducted as part of Kathryn Curtis's PhD Dissertation at York University.

Study Design:
The design of this study is called a "randomized controlled trial" which means that some participants will be selected by random to participate in a yoga program right away, and some participants will be selected by random to wait for 6 weeks and then participate in a yoga program. If you decide to participate in this research project, you will be able to participate in a yoga program, either right away or after 6 weeks.

Study Visits and Procedures:
You are being invited to participate in a specialized yoga program that involves two Hatha Yoga classes each week for six weeks. The classes will consist of postures to be done from a sitting position that are specialized for individuals who use wheelchairs. The classes will also teach you how to do breathing practices, meditation and relaxation practices. There will be approximately 12 people in the class and a total of 24 people (maximum) in the study. You will also be asked to fill out questionnaires before and after the yoga program. This yoga program is being offered at no cost to you.

You will be asked to fill out questionnaires before starting and after finishing the yoga program, which will take about 30 minutes to complete each time. If you are assigned to the group that waits before you take the yoga program, you will also be asked to fill out a third set of questionnaires at the beginning of the study. You are also being asked to participate in an interview after the yoga program, which asks you about your experiences with the yoga program and will take about 30 minutes to complete. The post-intervention qualitative interviews will be audio recorded. To protect your privacy, your name will not be used in the interview. All files will be protected and saved on a secure server at the University Health Network (UHN) to

ensure confidentiality of information gathering during the interview. The files will be typed up by a member of the research team at Toronto Rehabilitation Institute. .

Risks:
Taking part in this study has risks. Some of these risks we know about. There is also a possibility of risks that we do not know about and have not been seen in humans to date. Please call the study investigator (Dr. Hitzig) if you have any side effects, even if you do not think it has anything to do with this study.

The risks we know of are: It is possible that by participating in a yoga practice, you may experience initial increases in pain as your body becomes accustomed to the physical demands. Although yoga has been shown to alleviate pain in a variety of medical conditions, it is possible that you may experience some initial muscle soreness or fatigue after the yoga classes. It is also possible that some of the questions we ask may make you feel slightly uncomfortable, as they are personal.

Benefits:
This research may benefit you directly in a variety of ways. You may experience lower levels of pain, fatigue, and stress, and may also experience feelings of relaxation, balance, and well-being. Furthermore, you may learn new ways to manage pain or difficult experiences.

Through your participation and the information you provide, you will be contributing to the body of literature on individuals who have sustained an SCI. We hope to better understand of the ways that yoga may be helpful in coping with the challenges that accompany having sustained SCI. As such, the information you provide may help to provide evidence that yoga could be a useful treatment for people, like you, who have sustained an SCI and may be engaging in recreational activities.

Reminders and Responsibilities:
If you choose to participate in this study, you may find it useful to attend all of the yoga classes, as the material in each class will build on previous classes. If you are experiencing pain at the time of the yoga classes, it is fine to come to the class and participate in the breathing and meditation portion of the classes (not do the movement).

Alternatives to Being in the Study:
Instead of participating in this study, you may choose to explore other recreation activities. For example, if you would like to partake in the recreation and gym activities provided by the Lyndhurst Centre, you can go through the admissions process and will also need a physician referral. You may also choose to find a yoga program that specializes in classes for individuals with SCI in the community.

Confidentiality:

Personal Health Information
If you agree to join this study, the study investigator and his/her study team will look at your personal health information and collect only the information they need for the study. Personal health information is any information that could identify you and includes your name, date of birth (month and year), new or existing medical records, that includes information about your condition.

Your participation in this study will also be recorded in your medical record at this hospital. This is for clinical safety purposes.

Research Information in Shared Clinical Records
If you participate in this study, information about you from this research project may be stored in your hospital file and in the UHN computer system. The UHN shares the patient information stored on its computers with other hospitals and health care providers in Ontario so they can access the information if it is needed for your clinical care. The study team can tell you what information about you will be stored electronically and may be shared outside of the UHN. If you have any concerns about this, or have any questions, please contact the UHN Privacy Office at [redacted] (or by email [redacted]).

Representatives of UHN including the UHN Research Ethics Board may come to the hospital to look at the study records and at your personal health information to check that the information collected for the study is correct and to make sure the study is following proper laws and guidelines.

The study investigator will keep any personal health information about you in a secure and confidential location for 10 years. A list linking your study number with your name will be kept by the study investigator in a secure place, separate from your study file.

All information collected during this study, including your personal health information, will be kept confidential and will not be shared with anyone outside the study unless required by law. You will not be named in any reports, publications, or presentations that may come from this study.

Voluntary Participation:
Your participation in this study is voluntary. You may decide not to be in this study, or to be in the study now and then change your mind later. You may leave the study at any time. Your decision not to participate will not influence 1) the nature of your relationship with UHN or York University either now, or in the future, or 2) with any of the researchers, study staff or anyone at UHN.

We will give you new information that is learned during the study that might affect your decision to stay in the study.

Withdrawal from the Study:
You can stop participating in the study at any time, for any reason, if you so decide. Your decision to stop participating, or to refuse to answer particular questions, will not affect your relationship with the staff at UHN, the researchers, York University, or any other group associated with this project. In the event you withdraw from the study, and you do not want the researchers to use the information collected, they will destroy the data upon your request. You have the rights to any of the data collected.

Costs and Reimbursement: You will be reimbursed for money spent on transportation in order to participate in this study.

Rights as a Participant:
If you are harmed as a direct result of taking part in this study, all necessary medical treatment will be made available to you at no cost.

By signing this form you do not give up any of your legal rights against the investigators, sponsor or involved institutions for compensation, nor does this form relieve the investigators, sponsor or involved institutions of their legal and professional responsibilities.

Incidental Finding:
If you are diagnosed with a new physical or mental health condition while you are participating in the study or if we have reason to believe that you have a medical condition for which you are not receiving care, then we will encourage you to seek the right medical care right away. You will still be able to participate in the yoga study.

Conflict of Interest:
Researchers have an interest in completing this study. Their interests should not influence your decision to participate in this study.

Commercialization:
It is possible that the results of this study may be published in academic settings. It is also possible that the results of this study may be published in mainstream print or online press (e.g. magazines, newspapers, internet articles). You would not be identified in any of these publications.

Questions about the Study:
If you have any questions or concerns about the study or would like to speak to the study team for any reason, please call: Kathryn Curtis, or Dr. Joel Katz either by telephone at [redacted] or by e-mail [redacted].

If you have any questions about your rights as a research participant or have concerns about this study, call the Chair of the University Health Network Research Ethics Board (UHN REB) or the Research Ethics office number at [redacted]. The REB is a group of people who oversee the ethical conduct of research studies. The UHN REB is not part of the study team. Everything that you discuss will be kept confidential. You can also contact the Sr. Manager & Policy Advisor for the York University Office of Research Ethics, 5th Floor, York Research Tower, York University: telephone: [redacted] or e-mail: [redacted].

You will be given a signed copy of this consent form.

Consent:

This study has been explained to me and any questions I had have been answered.
I know that I may leave the study at any time. I agree to the use of my information as described in this form. I agree to take part in this study.

_____ _____ _____

Print Study Participant's Name Signature Date

My signature means that I have explained the study to the participant named above. I have answered all questions.

_____ _____ _____

Print Name of Person Obtaining Consent Signature Date

Was the participant assisted during the consent process? ☐YES ☐NO

If **YES**, please check the relevant box and complete the signature space below:

☐ The person signing below acted as an aid for participants with limited mobility during the consent process and attests that participant accurately understands the study as set out in this form and provides informed consent to participate.

_____ _____ _____

Print Name of Aid Signature Date

_____

Relationship to Participant

Appendix C: REB Approvals from UHN and York University HPRC

University Health Network
Research Ethics Board
10th Floor, Room 1056
700 University Ave
Toronto, Ontario, M5G 1Z5
Phone: (416) 581-7849

Notification of REB Initial Approval

Date: September 15th, 2015
To: Dr. Sander L. Hitzig
Toronto Rehabilitation Institute
520 Sutherland Drive, Lyndhurst Centre
Toronto, Ontario, Canada
M4G 3V9

Re: 15-9413-D
Evaluation of A Specialized Yoga Program for Persons with Spinal Cord Injury: A Randomized Controlled Trial

REB Review Type:	Full Board
REB Meeting Date:	July 22nd, 2015
REB Initial Approval Date:	September 15th, 2015
REB Expiry Date:	September 15th, 2016

Documents Approved:

Protocol	Version date: August 28th, 2015
Consent Form	Version date: August 28th, 2015
Appendix 5 - Inclusion and Exclusion Criteria for Staff	Version date: August 28th, 2015
Appendix 4: Recruitment Materials (Flyer/Email Script)	Version date: August 28th, 2015
Appendix 3: Qualitative Questionnaires	Version date: August 28th, 2015
Appendix 2: Demographic Information, Health History and Current Health Status	Version date: August 28th, 2015
Appendix 1: Quantitative Measures	Version date: August 28th, 2015

The UHN Research Ethics Board operates in compliance with the Tri-Council Policy Statement; ICH Guideline for Good Clinical Practice E6(R1); Ontario Personal Health Information Protection Act (2004); Part C Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations and the Medical Devices Regulations of Health Canada. The approval and the views of the REB have been documented in writing. The REB has reviewed and approved the clinical trial protocol and informed consent form for the trial which is to be conducted by the qualified investigator named in the letter.

Furthermore, members of the Research Ethics Board who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

Best wishes on the successful completion of your project.

Sincerely,

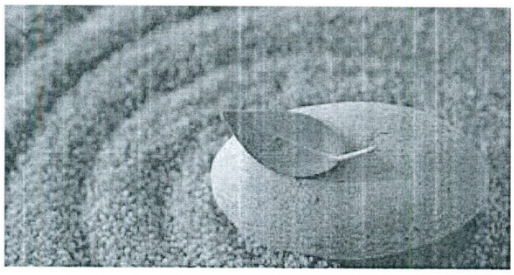
[redacted]

Ann Heesters, BA MA BEd PhD (ABD)
Co-Chair, University Health Network Research Ethics Board

YORK UNIVERSITÉ UNIVERSITY

UHN Toronto Rehabilitation Institute

YOGA STUDY



We are looking for volunteers to participate in a specialized 6-week yoga program at the Lyndhurst Centre. We are looking for individuals who have sustained spinal cord injury (SCI) and who have had little or no experience doing yoga. Participation involves attending two yoga classes per week for 6 weeks and filling out some questionnaires before and after the yoga program.

The yoga classes will be specialized for individuals who are using wheelchairs and so all poses will be done in a seated position. However, it is not necessary to be in a wheelchair to participate. Each Hatha yoga class will be 50-60 minutes long, and will consist of upper body yoga postures, breathing techniques and relaxation practices. Hatha yoga is based on the development of mind-body unity and balance, and has been selected as an appropriate form of yoga for individuals with SCI since it is gentle and can be easily modified to accommodate for mobility difficulties. It focuses on breathing techniques and awareness building practices rather than strength building, though there is also an emphasis on movement.

If you are interested, you will be invited to an information session where you will have a chance to ask any questions. Should you decide to participate, you will fill out an informed consent form and then will be asked to obtain a physicians note indicating it is safe for you to participate. You will be asked to fill out some questionnaires and hand in the physicians note prior to the first yoga class. If you're interested in participating, please contact Kathryn Curtis, one of the study researchers, if you're interested in participating: [redacted] or [redacted].

Please note that the security of e-mail messages is not guaranteed. Messages may be forged, forwarded, kept indefinitely, or seen by others using the internet. Do not use e-mail to discuss information you think is sensitive. Do not use e-mail in an emergency since e-mail may be delayed.

28/08/15

UHN Toronto General Toronto Western Princess Margaret Toronto Rehab

University Health Network
Research Ethics Board
10th Floor, Room 1056
700 University Ave
Toronto, Ontario, M5G 1Z5
Phone: (416) 581-7849

Notification of REB Amendment Approval

Date: January 18th, 2016
To: Dr. Sander L. Hitzig
Lyndhurst Centre, Toronto Rehabilitation Institute
520 Sutherland Drive
Toronto, Ontario, Canada
M4G 3V9

Re: 15-9413-D
Evaluation of A Specialized Yoga Program for Persons with Spinal Cord Injury: A Randomized Controlled Trial

REB Review Type:	Expedited
REB Initial Approval Date:	September 15th, 2015
REB Amendment Approval Date:	January 18th, 2016
REB Expiry Date:	September 15th, 2016

Documents Approved:

Amendment Form	Received on: December 9th, 2015
Consent Form	Version date: November 17th, 2015
Recruitment Ad - Flyer - Email Script	Version date: November 17th, 2015
Protocol	Version date: November 17th, 2015

The UHN Research Ethics Board approves the current protocol for this study as modified by the above listed document(s).

The UHN Research Ethics Board operates in compliance with the Tri-Council Policy Statement; ICH Guideline for Good Clinical Practice E6(R1); Ontario Personal Health Information Protection Act (2004); Part C Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations and the Medical Devices Regulations of Health Canada. The approval and the views of the REB have been documented in writing. The REB has reviewed and approved the clinical trial protocol and informed consent form for the trial which is to be conducted by the qualified investigator named in the letter.

Furthermore, members of the Research Ethics Board who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

Best wishes for the successful completion of your project.

Sincerely,

[redacted]

Janice Padilla- Moseley
Research Ethics Coordinator

For: Ann Heesters, BA MA BEd PhD (ABD)
Co-Chair, University Health Network Research Ethics Board

OFFICE OF RESEARCH ETHICS (ORE)
5th Floor, York Research Tower,
4700 Keele Street, Toronto ON
Canada M3J 1P3
Tel 416-736-5914, Fax 416-650-8197
www.research.yorku.ca

Memo

To: Joel Katz, Psychology/Health

From: Alison M. Collins-Mrakas, Sr. Manager and Policy Advisor, Research Ethics

Issue Date: Wed Nov 11 2015

Expiry Date: Fri Nov 11 2016

RE: Evaluation of a Specialized Yoga Program for Persons with Spinal Cord Injury (SCI): A Randomized Controlled Trial
Certificate #: e2015 - 316

I am writing to inform you that the Human Participants Review Sub-Committee has reviewed and approved the above project.

Should you have any questions, please feel free to contact me at: [redacted] or via email at: [redacted].

Yours sincerely,

Alison M. Collins-Mrakas M.Sc., LLM
Sr. Manager and Policy Advisor,
Office of Research Ethics

RESEARCH ETHICS: PROCEDURES to ENSURE ONGOING COMPLIANCE

Upon receipt of an ethics approval certificate, researchers are reminded that they are required to ensure that the following measures are undertaken so as to ensure on-going compliance with Senate and TCPS ethics guidelines:

1. **RENEWALS:** Research Ethics Approval certificates are subject to annual renewal.
    a. Researchers will be reminded by ORE, in advance of certificate expiry, that the certificate must be renewed
        i. Researchers have 2 weeks to comply to a reminder notice;
        ii. If researchers do not respond within 2 weeks, a final reminder will be

forwarded. Researchers have one week to respond to the final notice;

b. **Failure to renew an ethics approval certificate or** (to notify ORE that no further research involving human participants will be undertaken) **may result in suspension of research cost fund and access to research funds may be suspended/withheld ;**

2. **AMENDMENTS:** Amendments must be reviewed and approved **PRIOR** to undertaking/making the proposed amendments to an approved ethics protocol;

3. **END OF PROJECT:** ORE must be notified when a project is complete;

4. **ADVERSE EVENTS:** Adverse events must be reported to ORE as soon as possible;

5. **AUDIT:**
   a. More than minimal risk research may be subject to an audit as per TCPS guidelines;
   b. A spot sample of minimal risk research may be subject to an audit as per TCPS guidelines.

FORMS: As per the above, the following forms relating to on-going research ethics compliance are available on the Research website:

1. Renewal
2. Amendment
3. End of Project
4. Adverse Event

YORK
UNIVERSITÉ
UNIVERSITY

OFFICE OF RESEARCH ETHICS (ORE)
5th Floor,
Kaneff Tower

4700 Keele St.
Toronto ON
Canada M3J 1P3
Tel 416 736 5914
Fax 416 736-5512
www.research.yorku.ca

Memo

To: Professor Joel Katz, Department of Psychology, Faculty of Health, [redacted]
Dr. Sander L. Hitzig, Toronto Rehabilitation Institute

From: Alison M. Collins-Mrakas, Sr. Manager and Policy Advisor, Research Ethics
(on behalf of Denise Henriques, Chair, Human Participants Review Committee)

Date: **Thursday, January 28, 2016**

Re: **Ethics Approval - Hospital/ Clinical/ Medical Facilities**

I am writing to inform you that the Human Participants Review Sub-Committee has received a copy of your hospital/ medical facility ethics amendment approval certificate.

Further ethics review is not required by the York University Research Ethics Board as the research is minimal-risk and had undergone a delegated review by the respective hospital/ medical REB. If there are any changes to the risk or review level, you are required to notify the Office of Research Ethics as a full review will be required by the York University Research Ethics Board.

Name of Institution:	University Health Network
Principal Investigator:	Dr. Sander L. Hitzig, Toronto Rehabilitation Institute Professor Joel Katz, York University
Research Title:	Evaluation of a Specialized Yoga Program for Persons with Spinal Cord Injury (SCI): A Randomized Controlled Trial
REB approval cert. #:	15-9413-D
Approval Period:	09/15/15-09/15/16 Amendment Approved: 01/18/16

Please note that you are required for forward renewal and amendment certificates for our records.
Should you have any questions, please feel free to contact me at: [redacted] or via email at: [redacted]

Yours sincerely,

Alison M. Collins-Mrakas M.Sc., LLM
Sr. Manager and Policy Advisor,
Office of Research Ethics

Research Conducted in Hospital/ Clinical/ Medical Facilities

With a few exceptions, research conducted within a hospital or in conjunction with a hospital and/or medical facility requires REB approval from both the medical facility and the York REB (the HPRC). Given that the Hospital/Medical facility REB will have greater clinical expertise with regards to reviewing the protocols, the YORK REB requires the Hospital/Medical facility REB to review and approve the protocol *prior to* the protocol being submitted for review and approval by the HPRC.

However, as such research is often collaborative in nature and/or multi-jurisdictional in oversight, there are a number of mechanisms available to both researchers and the HPRC to address the complexities of ethics review. To avoid duplication of effort and to streamline the review process, and absent a reciprocal agreement with the medical institutions, researchers should be advised of the following when submitting a protocol for review:

- If the medical institution undertakes a full-board review[1] of the research ethics protocol, then a delegated review will be required by the York U REB (the HPRC)
- If the hospital does not require a full board review but rather undertakes a delegated review, then further review by the York U REB (the HPRC) is not required. The HPRC may accept the medical institution's REB approval certificate as appropriate review and approval of the protocol.

NOTE: Regardless of which review is being conducted, the Office of Research Ethics must be copied on or receive a copy of the results of the medical institution's review.

The Following is a summary chart outlining the decision points:

Research Risk Level	Medical Institution	YorkU
Minimal risk research	Delegated Review	No review required*
More than minimal risk research.	Full-board Review	Delegated review required

Further, as the research will be conducted in a clinical setting, the primary contact for REB queries will be the hospital's REB, though York REB will also remain as a contact in most instances.

NOTE: Protocols for research to be conducted in hospital/medical settings will not be accepted for review by the HPRC unless Hospital/medical facility REB approval is appended.

[1] Please consult the Senate Policy on Research Involving Human Participants for definitions of Full versus Delegated review.